CONSTRUCTION AND TESTS OF AN AMERICAN TYPE OF LOCOMOBILE

BY

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ARMOUR INSTITUTE OF TECHNOLOGY

1913

Details of Construction with Results of Tests of an American Type of

Locomobile

(BUCKEYE MOBIEL)

A Thesis

presented by

FRANK ROWELL GOLDSMITH

to the

President and Faculty

of

Armour Institute of Technology

for the Degree of

MECHANICAL ENGINEER

Having completed the prescribed course of study in Mechanical Engineering

May 24, 1913

Approved: F. F. Gebhardt
H. M. Raymond
L. C. Morrin

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Blue Prints of Table and Tests.

"Details of Construction and Tests of
An American Type Locomobile."
(The Buckeye-Mobile.)

For a number of years, engine builders have realized the limitations of the modern reciprocating steam engine, in the way of full economy. The gas engine with its low fuel consumption, especially when operated on producer gas, the extensive use of the oil engine, and the economies obtained with high pressure steam turbines, have also made it very apparent that something must be done with the steam engine, to bring it down on a footing with these prime movers of recent construction.

As a result all kinds of schemes and designs have been tried. Complicated triple and quadruple expansion engines have been made, equipped with the most modern of condensing machinery. Low pressure turbines have been attached to the exhaust of the steam engine, thus increasing the expansion possibilities of the steam, in an effort to obtain the last available atom of energy in the steam before it was rejected or returned to its original state.

Tests of reciprocating engines using ordinary saturated steam show a loss of from 15 to 30% due to initial condensation and consequent re-evaporation of the steam, this action resulting in the virtual by-passing of the above percentage of steam around the piston with-

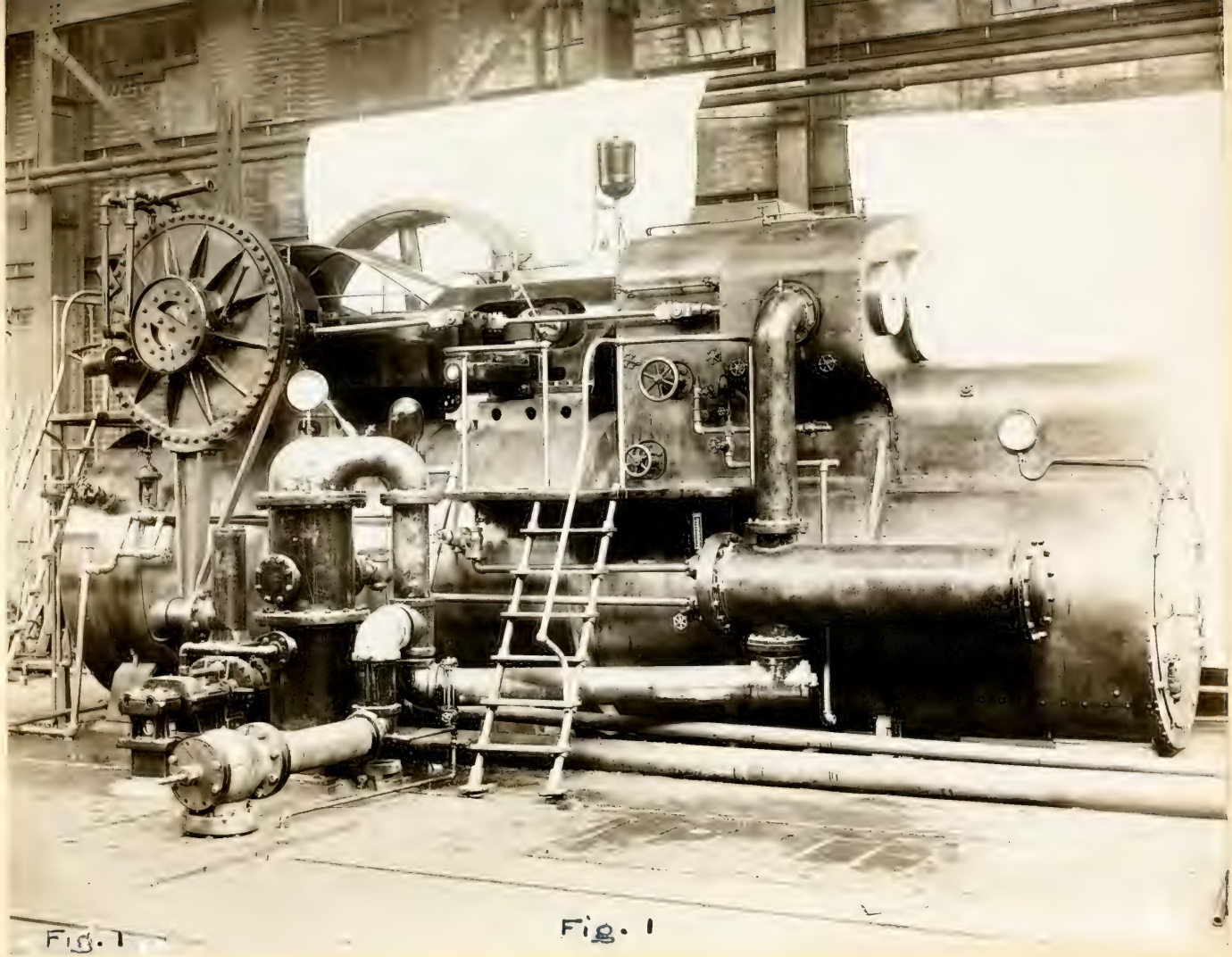


Fig. 1

Fig. 1

out effective work. Of the various means in use for reducing this loss, the application of superheated steam has proven by far the most effective. Steam when superheated assumes the properties of a true gas, in that it is possible for it to give up a number of heat units without condensing. Furthermore superheated steam is a poor conductor of heat and therefore the interchange of heat between the steam and the cylinder walls is much less rapid than when using ordinary saturated steam.

Superheated steam has been tried on power plants of the conventional type, but due to the fact that much of the superheat is lost thru radiation between boilers and engines the utmost advantage of economies are not possible. One of the most notable engineering achievementsof the past decade, along this line, has been the development in Europe of the high efficiency steam engine and boiler unit commonly known as the "Locomobile." The economical results obtained by this device have been so marked, that one of the oldest engine building companies in this country, The Buckeye Engine Co. of Salem, Ohio, has been led to make a most careful and thorough investigation of the principals employed. This has been done with the hope of offering to the American Power Using Public, a machine of equal merit. During the past year this company has constructed and tested a unit of this

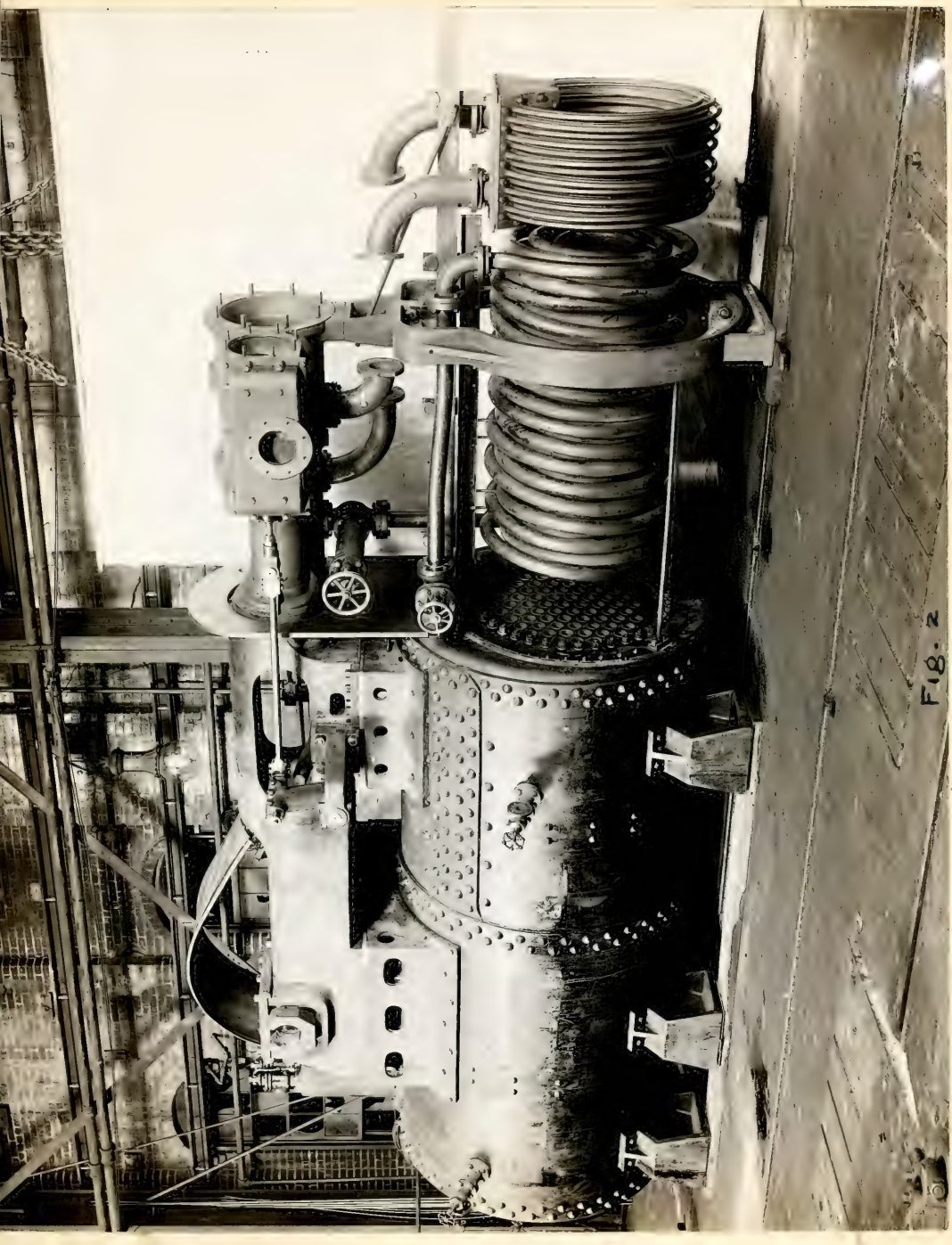


FIG. 2

May 4, 1913. 2:30 P.M. Condensing.
100# Spring. 200 r.p.m.
1.05# Coal per I.H.P.
9.2# Water " "

High Pressure

Test # 14.

May 4. 1913 2:30 P.M. Condensing
20# Spring 200 r.p.m.

Test # 14.

Low Pressure

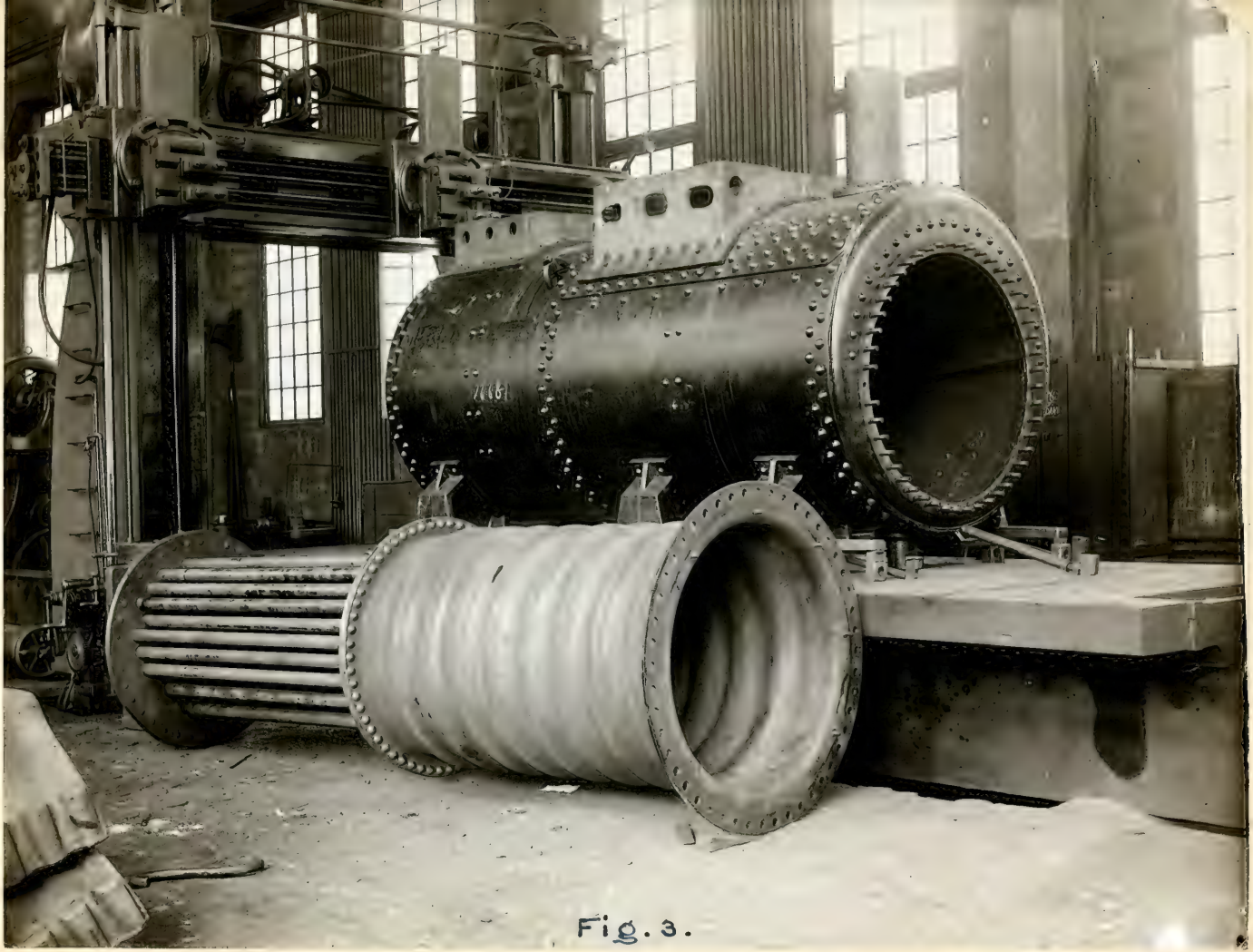


Fig. 3.

type and it is the purpose of this thesis to describe and illustrate this prime mover as it is now ready for the market, enclosing herewith, photographs and log and curve sheets of the various tests.

The Buckeye-Mobile, as this American Locomobile is called, is a complete self contained superheat power plant, consisting of an internally fired boiler, on which is mounted a compound engine, the cylinders of which are enclosed in the smoke box, shown in Figures I and 2. In order that the boiler may be thoroughly inspected and cleaned, the furnace and tubes are made removable by simply undoing a row of bolts on each end of the boiler, as shown in Figure 3. The boiler is supplied with water column, injector safety valves, blow-off valve&, to conform to the various local laws of the country. The cylinders are equipped with especially designed piston valves, adapted for the use of highly superheated steam, shown in Figures 4and 5. The smoke box contains also a superheater, a reheater and all necessary piping between boiler and cylinders, both for leading the steam from the boiler and thru the initial superheater to the high pressure cylinder, and the piping which conducts the steam from the high pressure cylinder thru the secondary superheater to the low pressure cylinder. The superheaters are enclosed in a special casing whereby the hot gases emerging from the boiler tubes are compelled

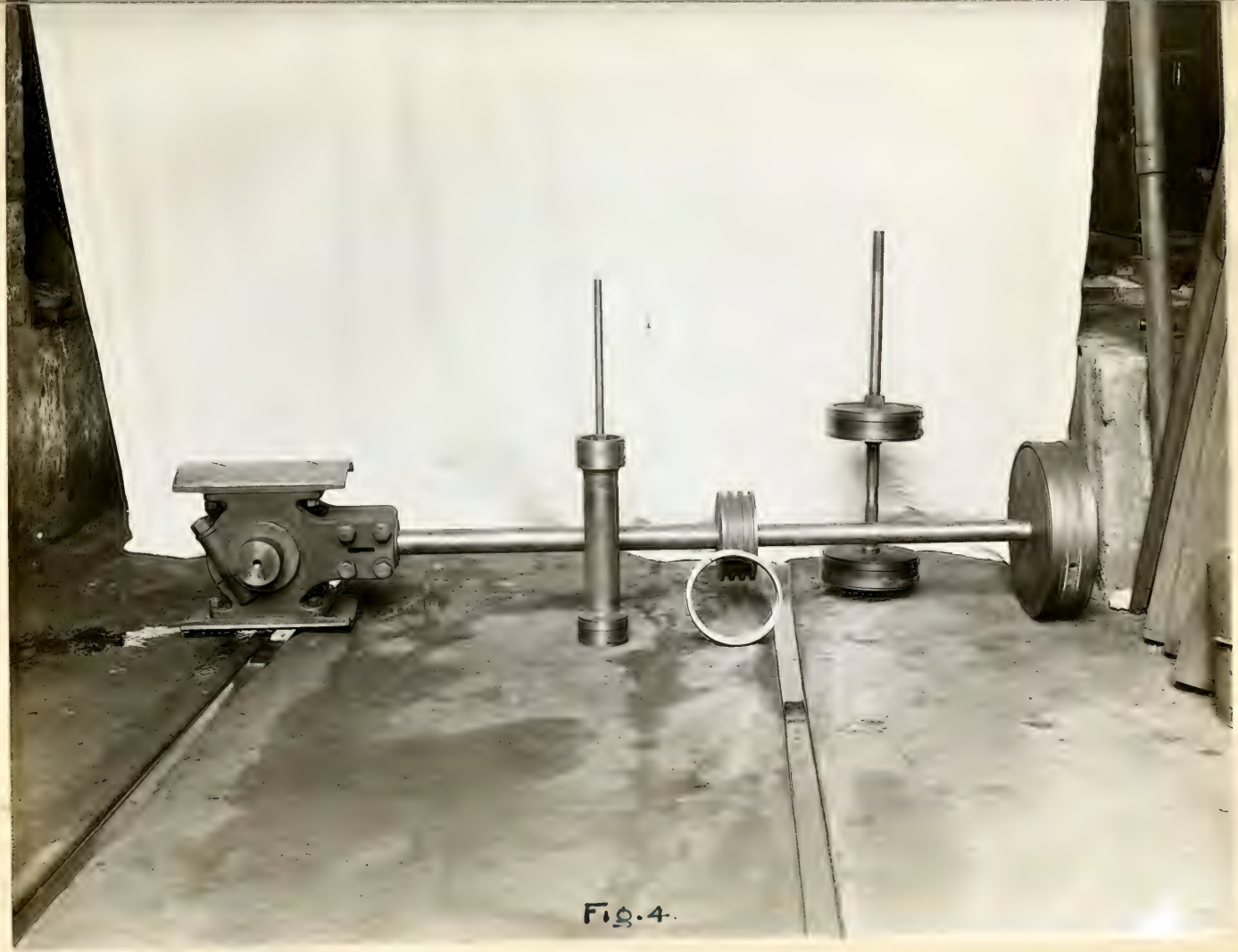


Fig. 4.

to traverse first the initial superheater and next the reheater before being discharged into the smoke box proper.

The initial superheater, Figure 6, is a single coil of seamless steel tubing, three inches in outside diameter, thru which the steam passes in a direction counter to that of the hot gases. The reheater, Figure 7, consists of two headers joined by a large number of one-inch seamless tubes. An effective steam jet blower enables the operator to thoroughly remove all soot and dust from these superheaters and boiler tubes as often as may be necessary.

The engine, Figure8, is of the centre crank type and is arranged for belting to line shaft, generator, or other machinery, Or a generator may be driven directly thru a flexible coupling. The engine bed is rigidly secured at the main bearing end to a massive paddle which spans about one third of the boiler's circumference. The guide barrel end rests on a small saddle and is free to slide thereon, thus relieving the bed from the effects of the expansion and contraction of the boiler. The piston rods pass thru the metallic packing of the labyrinth type, which has proved its value for use with high superheat.

The boiler feed pump is driven directly from the engine valve gear, and maintains a constant water level with very little adjustment. The steam as it leaves the low pressure cylinder passes thru a closed feed water heater, and

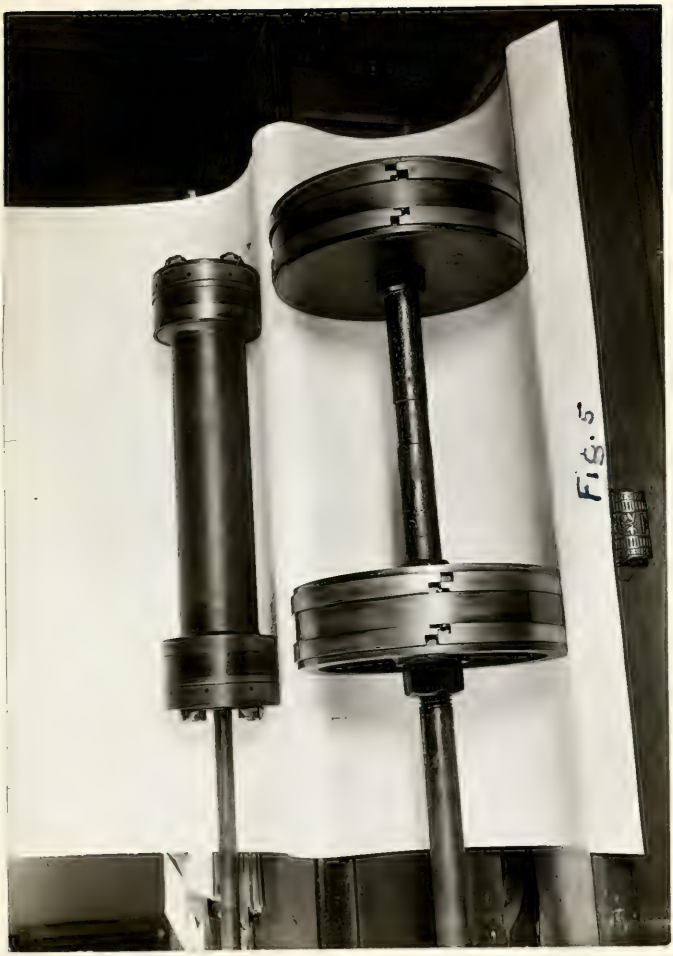


Fig. 5

May 4. 1913 2:15 P.M. Condensing
100# Springs 200 r.p.m.

High Pressure

Test # 14.

Cards taken during Test using
218° Superheat on H.P. Cyl
and
178° Superheat on L.P. Cylinder.

May 4. 1913 2:15 P.M. Condensing.

Test # 14.

Low Pressure

Fig. 6.

thence on to a suitable jet condenser with a rotary air pump, driven directly from the main engine shaft, all shown in Figure I.

Lubrication is made more positive by forcing the oil directly against the surfaces of the high pressure piston and valve as well as metallic packings, and is sprayed in with the steam to low pressure cylinder and valve.

During the months of October and November, 1912, exhaustive tests, with the use of the Alden Brake, were made on this self contained unit. The examination of the graphical summary of these tests will show the remarkable flatness of the fuel consumption curve. That is to say, this excellent economy is obtainable not only at the normal load, but at practically all loads above 50% of the rating and therefore the efficiency of the plant is varied but little by the changing load factor, a difficulty of other plants.

A pyrometer placed at the end of the boiler tubes, and high temperature thermometers in oil wells in various portions of the steam lines, has made it possible to note the changes that take place thruout the entire unit. From these frequent observations, graphical log sheets have been plotted. It will be noticed that altho the pyrometer readings vary quite extensively, caused by the firing of the coal the temperature of the steam to H.P. cylinder is more or less constant. This is brot about by the thick walls in the

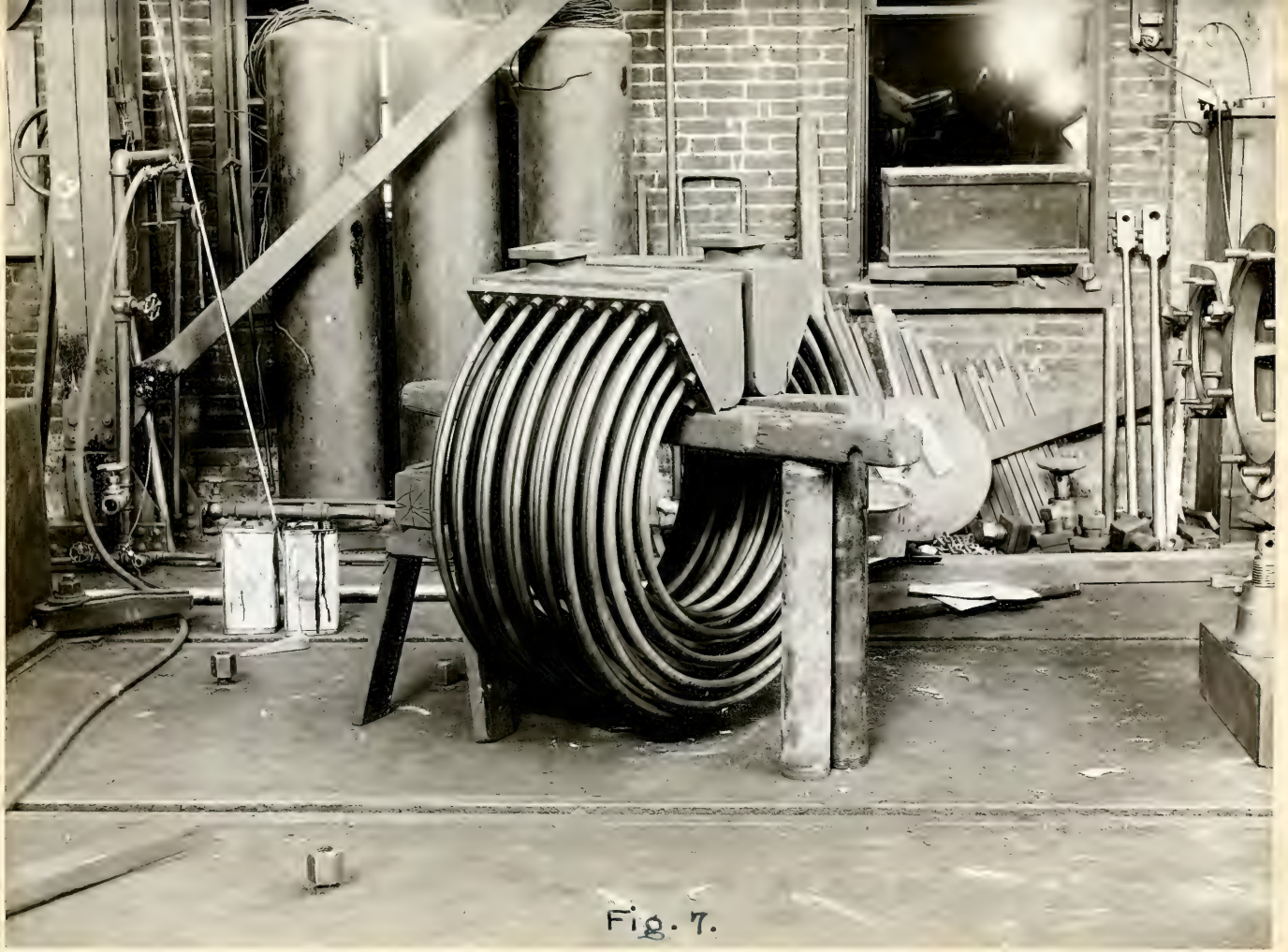


Fig. 7.

initial superheater, which gives storage capacity and thereby prevents such fluctuations of temperatures.

During the months of December, 1912, and January, 1913 the unit was removed from the test floor, erected in the shop and given a portion of the shop load. A daily log has been kept of its performances and these are shown in the blue print form. Due to the fact that the coals of this country are high in volatile matter, thus making them long flamed, results with the ordinary furnace, such as have been obtained in Europe, have been somewhat difficult to equal. It will be noticed however from the daily summary since January 30, 1913, that the extended furnace installed in April had much to do with the lowering of the fuel consumption, and that the use of Pocahontas select lump, brot this down during a special test of recent date to 1.08 lbs. of coal and 9.2 lbs. of water per indicated horse power hour. This goes to show what can be done with our American fuels with properly designed furnaces.

After several months of running, during which time high degrees of superheat were used, the engine was dismantled, and its cylinders, pistons, piston rods and valves were calipered, to note signs of wear. The tool marks were still visible in the cylinders and valve bushings and altho the reciprocating parts had turned a dark color, the rings were highly polished and showed no sign of wear. The piston rods were in perfect condition and there was no evidence

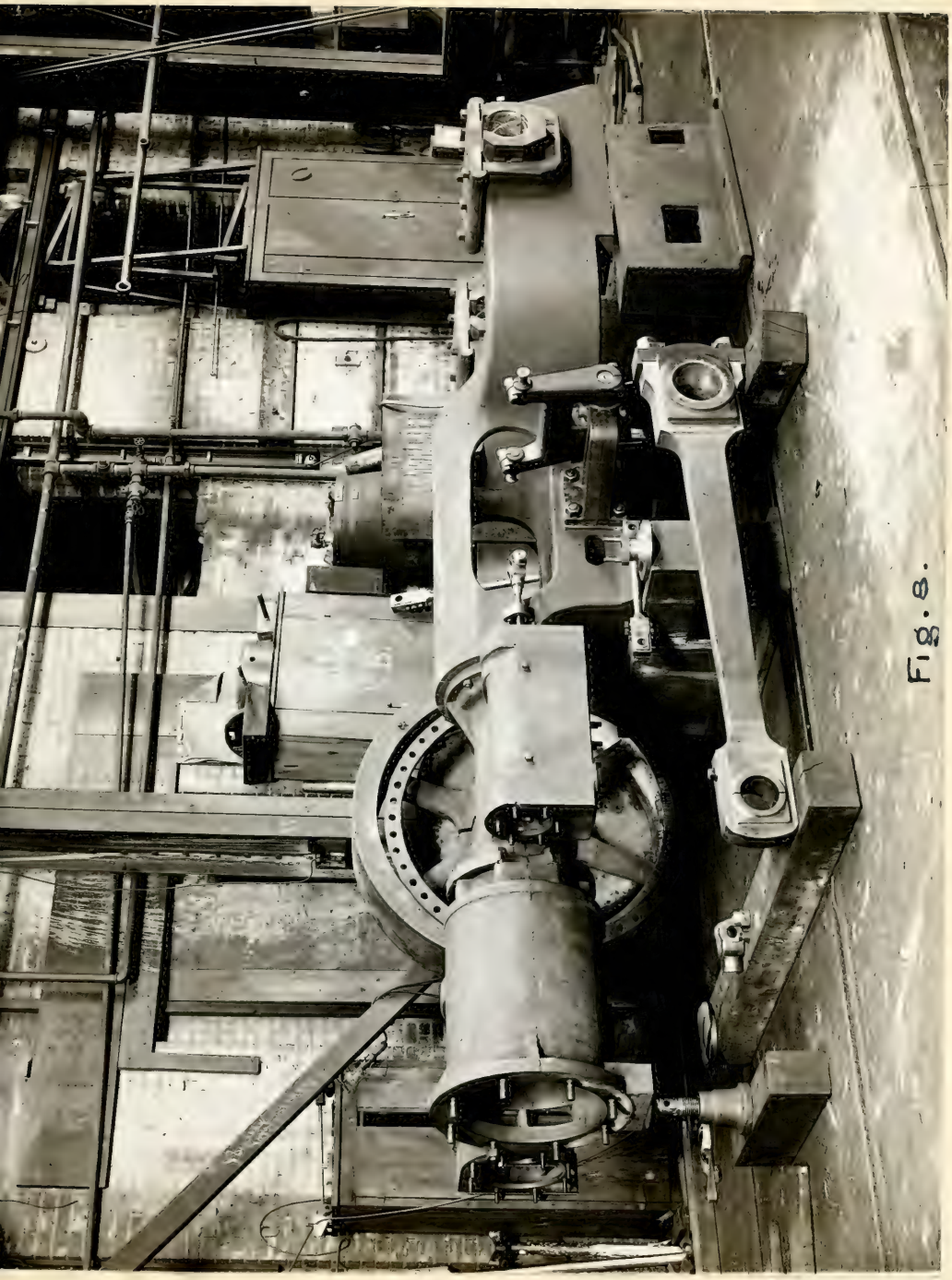
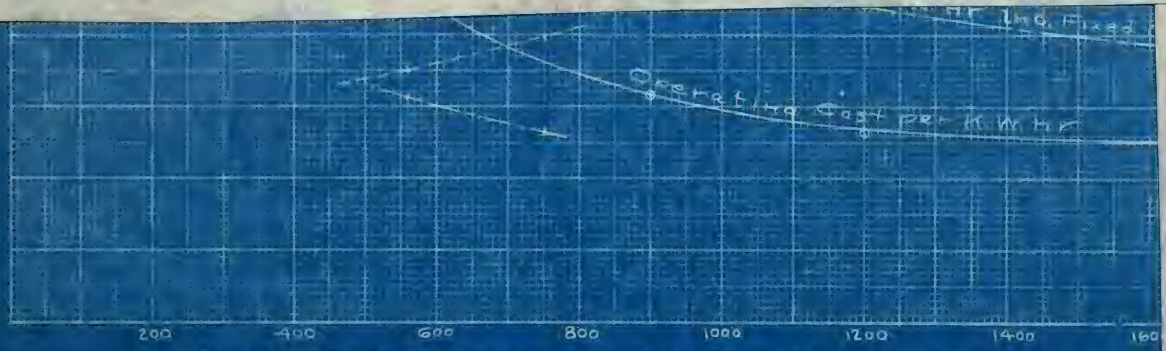


Fig. 8.

anywhere that excessive wear had taken place.

The more one works with this type of prime mover, the more he wonders why it has not been used in this country before this late date. It seems to be the only logical way to generate power. The unit makes it possible for the manufacturer to make and to fulfill a guarantee of the number of pounds of fuel per hosre power as against the usual guarantee of pounds of steam per horse power. One manufacturer delivers the complete unit, thereby avoiding the division of responsibilities between the makers, so noticeable in the usual power plant. In as much as the various elements which go to complete the old type of power plant are purchased from a number of builders, it is seldom that all parts are properly adapted to each other. Since the Locomobile is the product of one builder, who is free to choose the most suitable conditions as to steam pressures, superheat,&, he is able to so proportion all the elements ofthe unit as to secure the utmost efficiency of heat utilization, consistent with mechanical simplicity.

Small steam plants are extremely wasteful of fuel. In striking contrast the fuel consumption of the Locomobile, even in small sizes, produces a horse power hour on nine pounds of steam and between one and one and one half pounds of coal. Judging from figures of recent tests this amount will still be reduced.



Yearly Output in Thousands of Kilowatt Hours

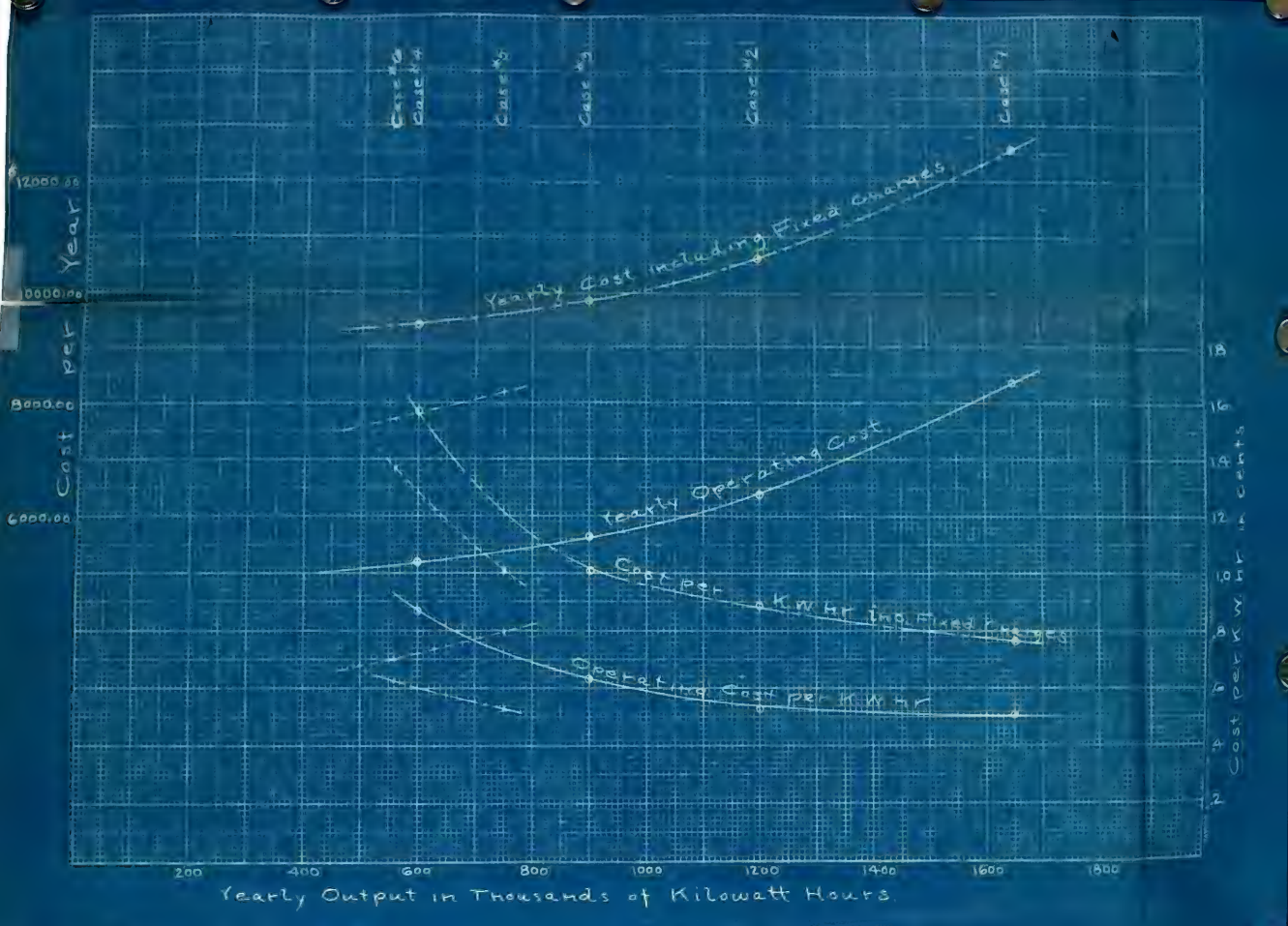
COSTS OF POWER PER YEAR AND PER KILOWATT PRODUCED BY

BUCKEYE LOCOMOBILE POWER PLANT

CONSISTING OF 2 150 K.V.A UNITS

BUCKEYE ENGINE

4-18-



Costs of Power per Year and per Kilowatt Produced by a Buckeye Locomobile Power Plant

Consisting of 2 150 K.V.A. Units

Buckeye Engine Co. Salem, Ohio.

4-18-1913

KEYE SUPERHEATED STEAM UNIT TESTS DURING OCTOBER 1912.

H.Ps. Referred to L.P.Cyl.	I.H.P.	Water				Coal				Vacuum 30" Bar.	Steam Pressure Gauge	Superheat Temperatures		Remarks.
		Total	Per Hour	Per B.H.P. Hr.	Per I.H.P. Hr.	Total	Per Hour	Per B.H.P. Hr.	Per I.H.P. Hr.			H.P. Cyl.	L.P. Cyl.	
TEST * 3. Oct. 14, 1912.														**142.2 I.H.P.**
28.47	142.2	4120	1373	10.82	9.65	665	222	1.75	1.56	27.15	196.5	256	214	Prony Brake Used. Slack 9th * Holwick Coal Used.
TEST * 4. Oct. 25, 1912.														**162 I.H.P.**
32.15	162	3278	1639	11.08	10.1	490	245	1.65	1.51	26.62	206.5	273	193	Alden Brake Used * Holwick Coal
TEST * 5. Oct. 26, 1912.														**128.2 I.H.P.**
24.42	128.2	3137	1255	10.9	9.78	1031	206.5	1.8	1.61	27.58	201.5	227.6	164.1	Alden Brake * Pittsburgh

Buckeye Superheated Steam Unit Tests During October 1912.

Hours of Run	R.P.M.	Net Wt on Scales	B.H.P.	M.E.Ps. H.P. Cyl.	M.E.Ps. L.P. Cyl.	M.E.Ps. Referred to L.P. Cyl.	I.H.P.	Water Total	Water Per Hour	Water Per B.H.P. Hr.	Water Per I.H.P. Hr.	Coal Total	Coal Per Hour	Coal Per B.H.P. Hr.	Coal Per I.H.P. Hr.	Vacuum 30" Bar	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks.
B.H.P. 127.								**TEST * 3. Oct. 14, 1912.**												**142.2 I.H.P.**
3	195.2	471	127	67.5	12.02	28.47	142.2	4120	1373	10.82	9.65	665	222	1.75	1.56	27.15	196.5	256	214	Prony Brake Used. Slack ⅛" Holwick Coal Used.
B.H.P. 148.								**TEST * 4. Oct. 25, 1912.**												**162 I.H.P.**
2	197.6	750	148	73.6	14.2	32.25	162	3278	1639	11.08	10.1	490	245	1.65	1.51	26.62	206.5	273	198	Alden Brake Used * Holwick Coal
B.H.P. 115.								**TEST * 5. Oct. 26, 1912.**												**128.2 I.H.P.**
3⅓	205.5	560	115	58.9	10.1	24.42	128.2	3137	1255	10.9	9.78	1031	206.5	1.8	1.61	27.58	201.5	227.6	164.1	Alden Brake * Pittsbuegh Coal
B.H.P. 154.								**TEST * 6. Oct. 28, 1912.**												**163.51 I.H.P.**
4 1/10	205.9	750	154	71.7	13.7	31.2	163.5	7238	1765	11.45	10.8	1084	265	1.72	1.62	27.27	198.5	273.5	196	Alden Brake * Pittsbuegh Coal
B.H.P. 192.								**TEST * 7. Oct. 29, 1912.**												**200 I.H.P.**
3 1/20	206.6	930	192	83.2	17.9	38.11	200	6037	1975	10.25	9.9	977	320	1.67	1.6	27.23	204	302	229	Alden Brake * Pittsbuegh and * Holwick Coal.

Analysis of Coals Used. – Run of Mine.

	Holwick	Pittsbuegh
Volatile Matter	42.65	35.50
Fixed Carbon	50.32	56.10
Ash	7.13	8.40
	100.00	100.00
B.T.U.	– 14398	– 14078
Sulphur	– 1.94%	– 2.12%

SUMMARY OF BUCKEYE LOCOMOBILE ON SHOP LOAD

s n	Total Lbs. Coal	Coal per Hr.	Total K.W. Hrs.	K.W. Hrs per Hr.	Load Factor	Coal per K.W. Hr.	Coal per I.H.P. Hr.	Method of Operating	Remarks
	2260	251	715	79.5	63%	3.15	1.84	Condensing	Salem Mine Coal
	1486	297	465	93.0	74.4%	3.20	1.895	Condensing	Salem Mine Coal Poor Grade. Full of Dust
	1474	295	480	96	76.8%	3.12	1.93	Non Condensing	Pittsburgh Coal
	1232	246.5	440	88	70.5%	2.8	1.65	Condensing	Pittsburgh Coal
	1361	274	465	93	74.4%	2.95	1.75	Condensing	Pittsburgh Coal
2½	782	227	285	81.4	65%	2.745	1.63	Condensing	Pittsburgh Coal
3¼	1900	245	720	93	74.4%	2.64	1.56	Condensing	Holwick Coal
4½	1088	290	325	86.7	69.3%	3.35	1.97	Condensing	Salem Coal Full of Dust
5½	1279	290	400	90.6	72.5%	3.19	1.89	Condensing	Salem Coal Full of Dust
	3032	303.2	925	92.5	74.%	3.59	1.94	Condensing	Salem Coal Much Dust
								Condensing	McNab Hard Coal

DAILY SUMMARY OF BUCKEYE LOCOMOBILE ON SHOP LOAD

Date	Time Start	Time Stop	Hrs Run	Total Lbs. Coal	Coal per Hr.	Total K.W. Hrs.	K.W. Hrs per Hr.	Load Factor	Coal per K.W. Hr.	Coal per I.H.P. Hr.	Method of Operating	Remarks
Jan. 30	8:30 A.M.	5:30 P.M.	9	2260	251	715	79.5	63%	3.16	1.84	Condensing	Salem Mine Coal
Feb. 10	12:30 P.M.	5:30 P.M.	5	1486	297	465	93.0	74.4%	3.20	1.895	Condensing	Salem Mine Coal Poor Grade. Full of Dust
Feb. 11	12:30 P.M.	5:30 P.M.	5	1474	295	480	96	76.8%	3.02	1.93	Non Condensing	Pittsburgh Coal
Feb 12	12:30 P.M.	5:30 P.M.	5	1232	246.5	440	88	70.5%	2.8	1.65	Condensing	Pitts[illegible]
Feb. 14	12:30 P.M.	5:30 P.M.	5	1361	274	465	93	74.4%	2.95	1.75	Condensing	Pittsburgh Coal
Feb 15	8:00 A.M.	11:30 P.M.	3½	782	227	285	81.4	65%	2.745	1.65	Condensing	Pittsburgh Coal
Feb 17	8:00 A.M.	5:30 P.M.	7¾	1900	245	720	93	74.4%	2.64	1.56	Condensing	Holwick Coal
Feb. 20	1:45 P.M.	5:30 P.M.	3¾	1088	290	325	86.7	69.3%	3.35	1.97	Condensing	Salem Coal Full of Dust
Feb. 21	1:05 P.M.	5:30 P.M.	4 5/12	1279	290	400	90.6	72.5%	3.19	1.89	Condensing	Salem Coal (Full of Dust)
Feb. 24	6:30 A.M.	5:30 P.M.	10	3032	303.2	925	92.5	74%	3.59	1.94	Condensing	Salem Coal (Much Dust)
Feb. 25	8:10 A.M.	2:30 P.M.	5⅓	1290	242	433	81.2	65%	2.98	1.74	Condensing	McNab Hard Coal 14.09% Ash.
Feb. 25	2:30 P.M.	4:30 P.M.	2	525	262½	186	93	74.4%	2.82	1.68	Condensing	McNab Hard Coal + Salem Coal 75%
Feb. 26	6:30 A.M.	5:30 P.M.	10	2548	254.8	865	86.5	69.2%	2.94	1.73	Condensing	Salem Coal Run of Mine
Feb. 27	6:30 A.M.	5:30 P.M.	10	2892	289.2	990	99	79%	2.93	1.74	Condensing	Salem Coal Slack
Feb. 28	6:30 A.M.	5:30 P.M.	10	2683	268.3	915	91.5	73.2%	2.935	1.74	Condensing	Salem Coal Slack
Mar. 1	6:30 A.M.	11:30 P.M.	5	1301	260	460	92	73.5%	2.83	1.68	Condensing	Salem Coal Run of Mine
Mar. 3	8:10 A.M.	5:30 P.M.	8⅓	2341	281	780	93.6	74.8%	3.00	1.78	Condensing	Salem Coal Run of Mine
Mar. 4	6:30 A.M.	5:30 P.M.	10	2805	280	930	98	78.4%	2.86	1.706	Condensing	Salem Coal Run of Mine
Mar. 5	6:30 A.M.	5:30 P.M.	10	2717	271.7	870	87	69.6%	3.12	1.84	Condensing	Salem Coal Run of Mine
Mar. 6	6:30 A.M.	5:30 P.M.	10	2641	264.1	876	87.6	70%	3.015	1.75	Condensing	Salem Coal Run of Mine Rogers Coal In Use 9:15 A.M.
Mar. 7	6:30 A.M.	5:30 P.M.	10	2589	258.9	845	84.5	67.6%	3.06	1.80	Condensing	Rogers Ohio Coal
Mar. 8	6:30 A.M.	11:30 A.M.	5	1120	260	340	78	62.4%	2.87	1.936	Condensing	Rogers Ohio Coal Salem Run of Mine Mixed

ECIAL TESTS ON BUCKEYE LOCOMOBILE DURING 1913.

H.P.	Load Factor	Water in Lbs. Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Coal in Lbs. Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Vacuum 30 Bar.	Steam Pressure Gauge	Degrees Superheat H.P. cyl.	L.P. cyl.	Remarks
TEST # 11. Mar. 30, 1913. Non Condensing.														150.2 I.H.P.
.2	74.8%					976	279	2.99	1.856	—	208	262	189	*Salem Coal. Good Quality. Hand Fired.
TEST # 12. Mar. 30, 1913. Condensing.														160.1 I.H.P.
0.1	76.5%					673	224.3	2.35	1.40	29¼	208.5	263	189.4	*Salem Coal. Good Quality. Hand Fired.
TEST # 13. May 4, 1913. Non-Condensing														153.5 I.H.P.

SPECIAL TESTS ON BUCKEYE LOCOMOBILE DURING 1913.

Hours of Run	R.P.M.	Total K.W. Hours	K.W. per Hour	I.H.P.	Load Factor	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per K.W. Hour	Water in Lbs. Per I.H.P. Hour	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per K.W. Hour	Coal in Lbs. Per I.H.P. Hour	Vacuum 30 Bar	Steam Pressure Gauge	Degrees Superheat H.P. cyl	Degrees Superheat L.P. cyl	Remarks
93.4 K.W.										TEST * 11. Mar. 30, 1913.				Non Condensing.				150.2 I.H.P.
3½	206	327	93.4	150.2	74.8%					976	279	2.99	1.856	—	208	262	189	*Salem Coal. Good Quality. Hand Fired.
95.6 K.W.										TEST * 12. Mar. 30. 1913.				Condensing.				160.1 I.H.P.
3	206	287	95.6	160.1	76.5%					673	224.3	2.35	1.40	23¾	208.5	263	189.4	*Salem Coal. Good Quality. Hand Fired.
95.7 K.W.										TEST * 13. May 4, 1913.				Non-Condensing				153.5 I.H.P.
3	200	287	95.7	153.5	76.5	5941	1980⅔	20.7	12.9	668	222.7	2.33	1.45	—	208	193	177	¶Pocahontas Lump. Hand Fired.
101.4 K.W.										TEST * 14. May. 4. 1913.				Condensing				169 I.H.P.
3½	200	355	101.4	169	81%	5440	1550	15.4	9.2	639	182.5	1.8	1.08	25.7	209	218	178	¶Pocahontas Lump. Hand Fired.

Kind of Coal	*Salem Lump	¶ Pocahontas Lump.
Moisture	1.63 %	.27 %
Volatile Matter	41.17	18.03
Fixed Carbon	51.10	76.70
Ash	6.10	5.00
Sulphur	3.63	.56
B.T.U. per Lb.	14282.31	14209.60

176 F25

SUMMARY OF BUCKEYE LOCOMOBILE ON SHOP LOAD

Hrs Run	Total lbs. Coal	Coal per Hr.	Total K.W. Hrs.	K.W. per Hr.	Load Factor	Coal per K.W.	Coal per I.H.P.	Method of Operating	Aver. Vacuum	Remarks.
[illegible]	1753	251	600	85.4	68.3%	2.92	1.735	Condensing	24 3/4	Salem Run of Mine 13,941 B.t.u. " Slack 13,760 B.t.u.
[illegible]	785	262	270	90.0	72.7%	2.91	1.805	Non Condensing	—	Salem Run of Mine 13,941 B.t.u. " Slack 13,760 B.t.u.
[illegible]	1724	246	625	75	60%	3.30	1.85	Condensing	23 3/4	Salem Run of Mine " Slack (Full of Dust) Rogers Ohio Coal
[illegible]	2566	256	770	77	61.3%	3.33	1.93	Condensing	23 1/4	Salem Run of Mine " Slack (Full of Dust)
[illegible]	2529	2529	745	74.5	59.6%	3.39	1.96	Condensing	22 1/4	Salem Slack. Full of Dust and Much Dirt. 13,760 B.t.u.
[illegible]	2035	2035	770	77	61.3%	2.64	1.53	Condensing	22 3/4	Salem Run of Mine Some Good Coal. Free from dirt & dust
[illegible]	2312	289	730	91.25	72.8%	3.17	1.965	Non Condensing	—	Rodgers Ohio Coal - Full of Dust & Dirt. 15,315 B.t.u.
[illegible]	1423	2846	415	83	66.5%	3.44	2.12	Non Condensing	—	Rodgers Ohio Coal [illegible]

Daily Summary of Buckeye Locomobile on Shop Load

Date 1911	Time Start	Time Stop	Hrs Run	Total Lbs Coal	Coal per Hr	Total H.P. Hrs.	Evaporation per Hr	Load Factor	Coal per H.P.	Coal per Lb Evap	Method of Operating	Avg. Vacuum	Remarks
Mar. 10	6:30 AM	5:30 P.M.	7	1773	251	600	85.4	68.3%	2.92	1.755	Condensing	24½	Salem Run of Mine 13,640 B.T.U. Slack 13,760 B.T.U.
Mar. 10	12 noon	5:30 P.M.	3	785	262	270	90.0	72.7%	2.91	1.803	Non Condensing	—	Salem Run of Mine 13,340 B.T.U. Slack 13,760 B.T.U.
Mar. 11	6:30 AM	5:30 P.M.	7	1724	246	625	75	60%	3.30	1.35	Condensing	23¼	Salem Run of Mine Rogers Ohio Coal Full of Dust
Mar. 12	6:30 AM	5:30 P.M.	10	2566	256	770	77	60.2%	3.33	1.43	Condensing	23¼	Salem Run of Mine Slack (Full of Dust)
Mar. 13	6:30 AM	5:30 P.M.	10	2529	252.9	745	74.5	59.6%	3.39	1.96	Condensing	22¾	Salem Slack, Full of Dust and Much Dirt. 13,760 B.T.U.
Mar. 14	6:30 A.M.	5:30 P.M.	10	2035	203.5	770	77	61.3%	2.64	1.55	Condensing	22¾	Salem Run of Mine Some Good Coal, Free from Dirt
Mar. 21	6:30 A.M.	5:30 P.M.	8	2312	289	730	91.25	72.8%	3.17	1.965	Non Condensing	—	Rodgers Ohio Coal Full of Dust + Dirt. 13,500 B.T.U.
Mar. 22	6:30 A.M.	11:30 A.M.	5	1423	284.6	415	83	66½%	3.43	2.12	Non Condensing	—	Rodgers Ohio Coal Full of Dust + Dirt. 13,500 B.T.U.
Mar. 24	6:30 A.M.	5:30 P.M.	10	3302	330.2	540	84	67.2%	4.16	2.57	Non Condensing	—	Rodgers Ohio Coal Full of Dust + Dirt. 13,500 B.T.U.
Mar. 25	2:00 P.M.	5:30 P.M.	3½	1000	285.5	345	98.6	78.8%	2.90	1.82	Non Condensing	—	Salem Mine Coal 14,000 B.T.U. Good Quality free from Dirt
Mar. 26	6:30 A.M.	5:30 P.M.	10	2991	299.1	1005	100.5	80.4%	2.98	1.785	Non Condensing	—	Salem Mine Coal 14,000 B.T.U. Good Quality free from Dust + Dirt
Mar. 27	6:30 A.M.	5:30 P.M.	10	2920	292	980	95	76%	3.08	1.89	Non Condensing	—	Salem Mine Coal 14,000 B.T.U. Good Quality. No Dirt.
Mar. 28	6:30 A.M.	5:30 P.M.	10	2920	292	990	89	71.2%	3.28	1.94	Non Condensing	—	Salem Mine Coal 13,500 B.T.U. Rodger Ohio Coal.
Mar. 29	6:30 A.M.	11:30 A.M.	5	1371	274.2	430	86	68.8%	3.19	1.93	Non Condensing	—	Salem Mine Coal 13,500 B.T.U. Rodgers Ohio Coal.
Apr. 1	6:30 A.M.	5:30 P.M.	8½	2134	251	760	89.4	71.5%	2.81	1.67	Condensing	24¼	Salem Coal 14,000 B.T.U. Good Quality No Dirt.
Apr. 2	7:30 A.M.	5:30 P.M.	9	2260	251	830	92.2	73.8%	2.72	1.615	Condensing	24¼	Salem Coal 14000 B.T.U Good Quality No Dirt.
** Apr. 8	2:35 P.M.	5:05 P.M.	2½	697	278	220	88	70.4%	3.16	1.77	Condensing	24½	Salem Mine Stoker Fired Good Quality 14000 B.T.U.
Apr. 9	9:10 A.M.	5:30 P.M.	7⅓	1838	252	620	84.6	67.6%	2.97	1.725	Condensing	24½	Shepherd Coal Salem & Stoker Fired.
Apr. 10	3:15 P.M.	5:30 P.M.	2¼	621	276	210	93.4	74.8%	2.95	1.815	Non Condensing	—	Salem Coal 14000 B.T.U. Good Quality Stoker Fired.
Apr. 11	1:30 P.M.	5:30 P.M.	3½	829	237	325	92.8	74.2%	2.55	1.515	Condensing	23¾	Salem Coal 14000 B.T.U. Good Quality Stoker Fired
Apr. 12	6:30 A.M.	11:30 A.M.	5	1141	228.2	390	78	62.4%	2.93	1.69	Condensing	24¼	Salem Coal 14000 B.T.U. Good Quality Stoker Fired
Apr. 14	6:30 A.M.	5:30 P.M.	10	2504	250.4	830	83	66.4%	3.02	1.735	Condensing	26	Salem Slack 13,760 B.T.U. Full of Dirt. Stoker Fired

* Vacuum Referred to 30" Barometer.

** Locomobile shut down from Apr. 2nd to Apr. 8th to install extended Furnace and Stoker

UMMARY OF BUCKEYE LOCOMOBILE ON SHOP LOAD.

	Total Lbs Coal	Coal per Hr.	Total K.W. Hrs.	K.W. Hrs per Hr.	Load Factor	Coal per K.W.Hr	Coal per I.H.P.Hr	Method of Operating	Aver* Vacuum	Remarks.
	215.3	215.3	845	84.5	67.6%	2.55	1.495	Condensing	25 1/4	Salem Lump 14000 B.t.u Good Quality. Hand Fired
3/4	1256	218.2	525	91.3	73%	2.39	1.415	Condensing	25 1/4	Salem Lump 14.282 B.T.U Good Quality. Hand Fired
	2112	211.2	835	83.5	67%	2.53	1.485	Condensing	25 1/4	Salem Lump 14.000 B.T.U. Good Quality Hand Fired.
	1321	2642	390	78	62.2%	3.36	2.06	Non-Condensing	—	Salem Run of Mine 13.843 B.T.U. Hand Fired.
5	1111	2222	425	85	68%	2.62	1.54	Condensing	25 1/4	Salem Run of Mine 13.843 B.T.U Hand Fired.
5	1311	2622	475	95	76%	2.76	1.64	Condensing	25 1/4	Salem Run of Mine 13.843 B.T.U Contained Dust. Hand Fired
5	1115	223	375	75	60%	2.97	1.719	Condensing	26	Salem Run of Mine 13.843 B.T.U Contained Dust. Hand Fired
5	1187	237	410	82	65.6%	2.89	1.68	Condensing	25 1/4	Salem Run of Mine 13.843 B.T.U Contained Dust. Stoker Fired.
3/4	1340	882	405	85	68%	3.32	1.94	Condensing	24 3/4	Salem Slack 13.760 B.T.U. Stoker Fired
										Salem Slack 13.760 B.T.U

Daily Summary of Buckeye Locomobile on Shop Load.

Date 1913.	Time Start.	Time Stop.	Hrs. Run	Total Lbs. Coal	Coal per Hr.	Total K.W. Hrs.	K.W. Hrs. per Hr.	Load Factor	Coal per K.W.H.	Coal per I.H.P. Hr.	Method of Operating.	Aver.* Vacuum	Remarks.
Apr. 15	6:30 A.M.	5:30 P.M.	10	2153	215.3	845	84.5	67.6%	2.55	1.495	Condensing	25¼	Salem Lump. 14000 B.T.U. Good Quality. Hand Fired.
Apr. 16	10:45 A.M.	5:30 P.M.	5¾	1256	218.2	525	91.3	73%	2.39	1.415	Condensing	25¼	Salem Lump. 14,282 B.T.U. Good Quality. Hand Fired.
Apr. 17	6:30 A.M.	5:30 P.M.	10	2112	211.2	835	83.5	67%	2.53	1.485	Condensing	25¼	Salem Lump. 14000 B.T.U. Good Quality. Hand Fired.
Apr. 18	6:30 A.M.	11:30 A.M.	5	1321	2642	390	78	62.2%	3.36	2.06	Non-Condensing	—	Salem Run of Mine 13,843 B.T.U. Hand Fired.
Apr. 18	12:30 P.M.	5:30 P.M.	5	1111	2222	425	85	68%	2.62	1.54	Condensing	25¼	Salem Run of Mine 13,843 B.T.U. Hand Fired.
Apr. 19	6:30 A.M.	11:30 A.M.	5	1311	2622	475	95	76%	2.76	1.64	Condensing	25¼	Salem Run of Mine 13,843 B.T.U. Contained Dust. Hand Fired.
Apr. 21	6:30 A.M.	11:30 A.M.	5	1115	223	375	75	60%	2.97	1.719	Condensing	26	Salem Run of Mine 13,843 B.T.U. Contained Dust. Hand Fired.
Apr. 21	12:30 P.M.	5:30 P.M.	5	1187	237	410	82	65.6%	2.89	1.68	Condensing	25¼	Salem Run of Mine 13,843 B.T.U. Contained Dust. Stoker Fired.
Apr. 22	6:30 A.M.	5:30 P.M.	4¾	1340	282	405	85	68%	3.32	1.94	Condensing	24¾	Salem Slack 13,760 B.T.U. Stoker Fired.
Apr. 23	6:30 A.M.	5:30 P.M.	10	2359	2359	875	87.5	70%	2.69	1.59	Condensing	24¾	Salem Slack 13,760 B.T.U. Stoker Fired.
Apr. 24	6:30 A.M.	11:30 A.M.	5	1201	240	405	81	65%	2.96	1.73	Condensing	24¾	Salem Slack 13,760 B.T.U. Stoker Fired.
Apr. 25	6:30 A.M.	5:30 P.M.	10	2123	212.3	835	83.5	67%	2.54	1.495	Condensing	25¼	Salem Mine. 13,843 B.T.U. Hand Fired.
Apr. 28	9:30 A.M.	5:30 P.M.	7	1874	267.7	720	102.9	82%	2.60	1.56	Condensing	24¼	Salem Mine Run. 13,843 B.T.U. Hand Fired
Apr. 29	6:30 A.M.	5:30 P.M.	10	2163	216.3	900	90	72%	2.40	1.42	Condensing	26½	Salem Mine Run 13,843 B.T.U. Hand Fired
Apr. 30	6:30 A.M.	5:30 P.M.	10	2138	213.8	865	86.5	69%	2.47	1.453	Condensing	25¼	Salem Mine Run 13,843 B.T.U. Hand Fired
May 1	6:30 A.M.	5:30 P.M.	10	1821	1821	835	83.5	66%	2.18	1.28	Condensing	24¾	Pocahontas Run of Mine Hand Fired. 13,966 B.T.U.
May 2	6:30 A.M.	5:30 P.M.	10	1991	199.1	865	86.5	69%	2.3	1.35	Condensing	24¾	Pocahontas Run of Mine Hand Fired. 13,966 B.T.U.
May 3	7:00 A.M.	10:30 A.M.	3½	634	181	270	77	61.6%	2.35	1.36	Condensing	25¼	Pocahontas Run of Mine Hand Fired. 13966 B.T.U.
May 5	6:30 A.M.	5:30 P.M.	10	1815	181.5	875	87.5	70%	2.075	1.225	Condensing	25¼	Pocahontas Run of Mine Hand Fired. 13,966 B.T.U.
May 6	6:30 A.M.	5:00 P.M.	9½	1658	174.5	790	83	66.4%	2.10	1.23	Condensing	26¾	Pocahontas Run of Mine Hand Fired 13,966 B.T.U.
May 7	6:30 A.M.	5:00 P.M.	9½	1780	187.5	885	93.2	74.6%	2.01	1.195	Condensing	26.45	Pocahontas Run of Mine Hand Fired. 13,966 B.T.U.
May 8	7:30 A.M.	5:30 P.M.	9	1817	201.8	825	91.6	73.3%	2.2	1.31	Condensing	26.2	Pocahontas Run of Mine Contained Much Dust. Hand Fired
May 9	6:30 A.M.	5:30 P.M.	10	1988	198.8	865	86.5	69.2%	2.3	1.35	Condensing	26.65	Pocahontas Run of Mine Much Dust. Hand Fired. 13,966 B.T.U.

*Vacuum Referred to 30" Barometer.

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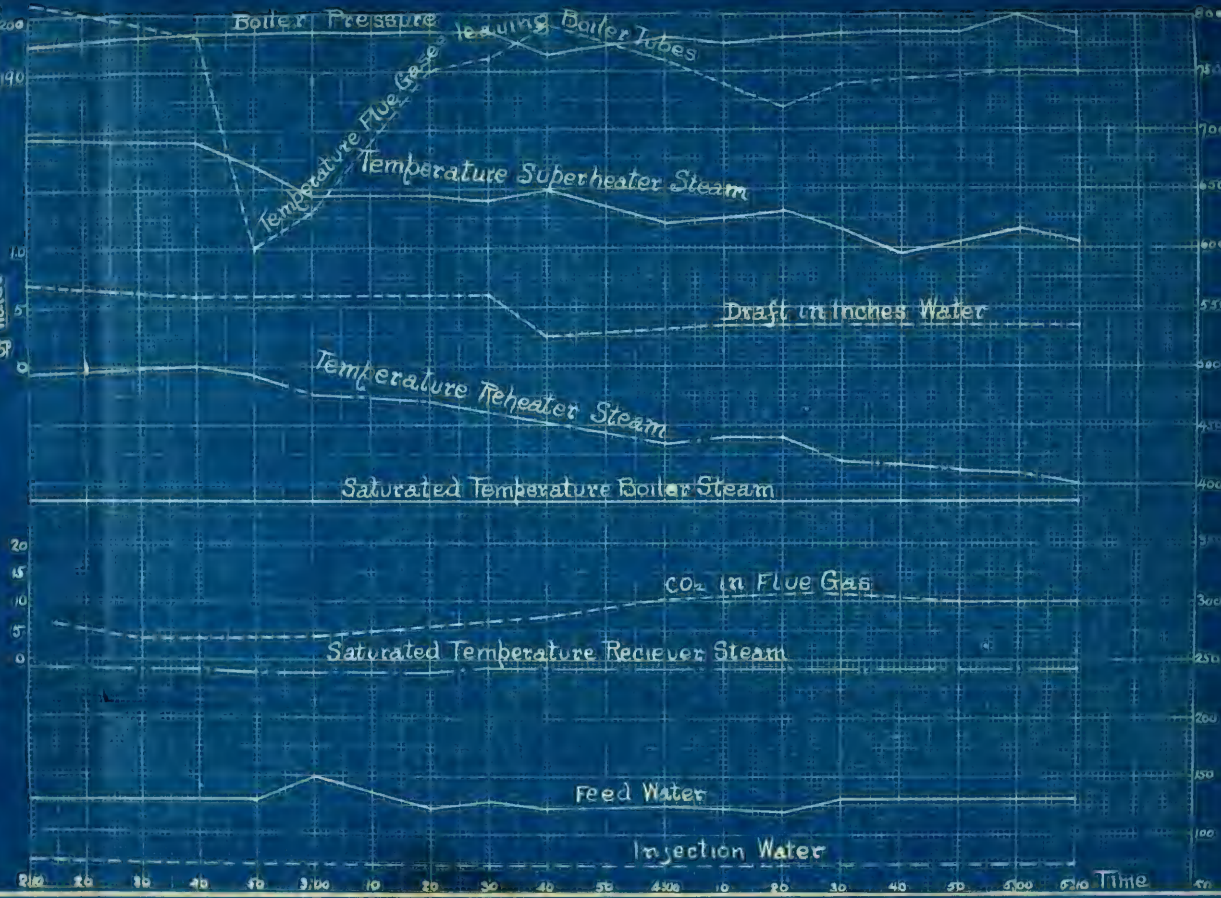
Test #3. October 14, 1912.

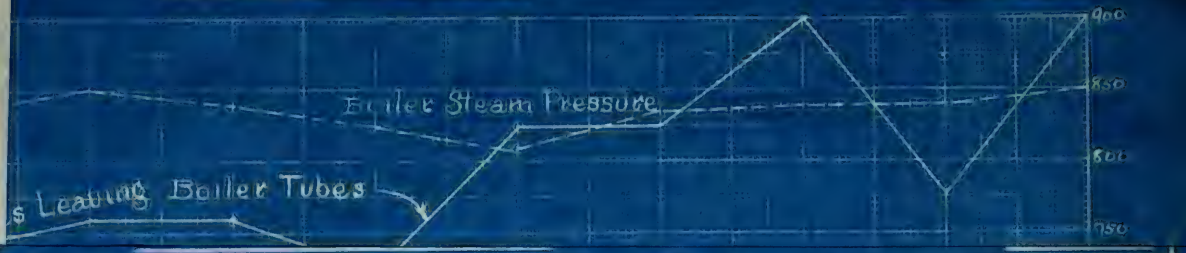
Test #3. October 14, 1912.



B.H.P. 127. TEST #3. Oct. 14, 1912 142.2 I.H.P.

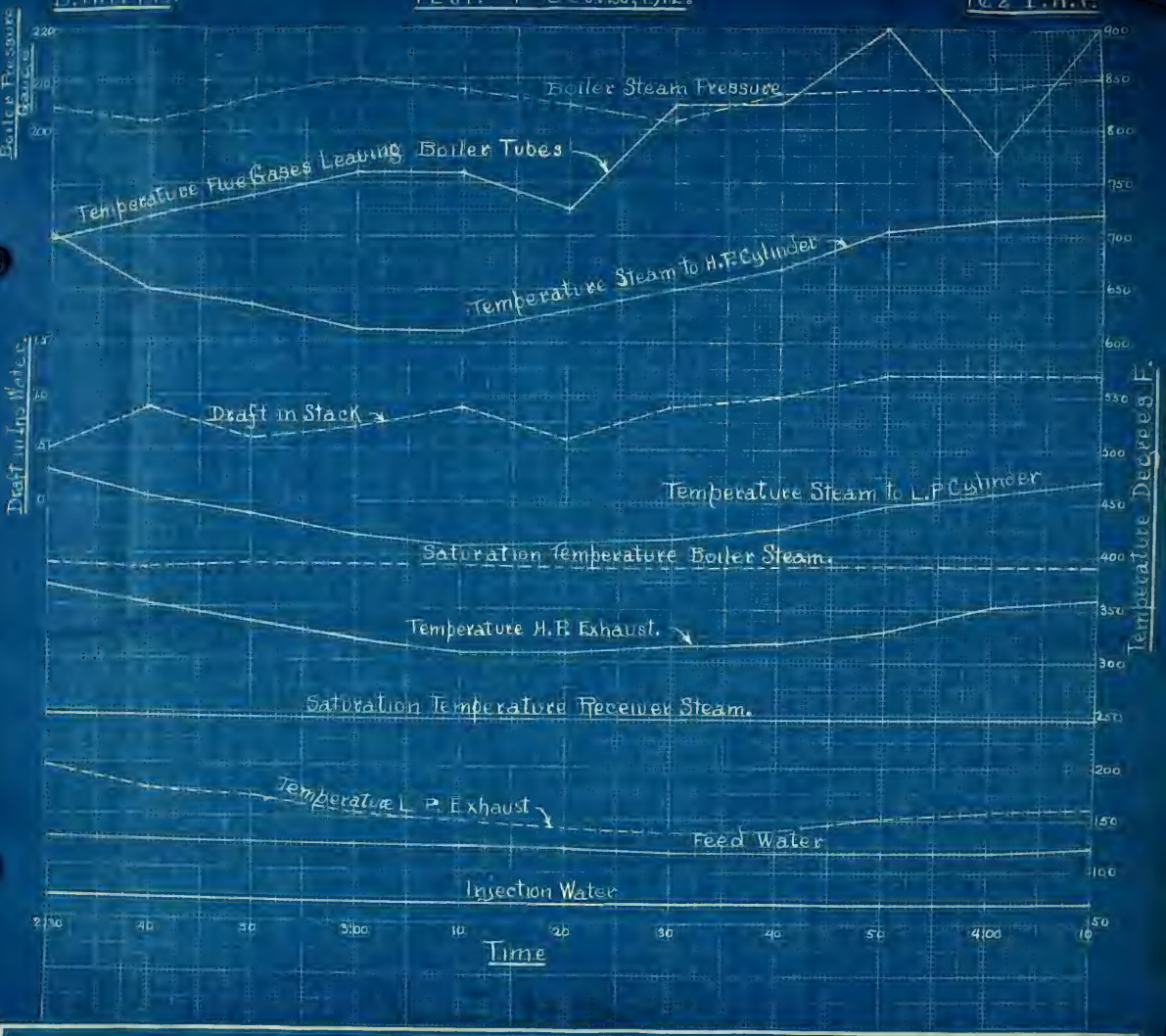
Hours of Run	R.P.M.	Net Wt. on Scales	B.H.P.	M.E.P. H.P. Cyl.	M.E.P. L.P. Cyl.	M.E.P. Reduced to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum Ins. Mer.	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks
3	195.2	471	127	67.5	12.02	28.47	142.2	4[illegible]	1373	10.82	9.65	665	222	1.75	1.56	27.13	196.3	256	214	Prony Brake Black and Hawker Coal Used During Test.

TEST. #4 Oct. 25, 1912. 162 I.H.P.



E.Ps.		I.H.P.	Water in Lbs.				Coal in Lbs.				Vacuum	Steam Pressure	Superheat Temperatures		Remarks
H.P. Cyl	Referr'd to L.P. Cyl		Total	Per Hour	Per B.H.P. Hr.	Per I.H.P. Hr.	Total	Per Hour	Per B.H.P. Hr.	Per I.H.P. Hr.	30 Bar.	Gauge	H.P. Cyl.	L.P. Cyl.	
9.2	32.18	162	3278	1639	11.08	10.1	490	245	1.65	1.51	26.92	206.5	273	193	Alden Brake Used.
															Hetwick Coal

B.H.P. 148. TEST. #4 Oct. 25, 1912. 162 I.H.P.



B.H.P. 148. TEST #4. Oct. 25, 1912. 162 I.H.P.

Hours of Run	R.P.M.	Net Wt. on Scales	B.H.P.	M.E.P.s H.P. Cyl.	M.E.P.s L.P. Cyl	M.E.P.s Referred to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum 30 Bar.	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks
2	197.6	730	148	73.6	14.2	32.15	162	8278	1639	11.08	10.1	490	245	1.65	1.51	28.62	206.5	273	193	Alden Brake Used
																				Helwier Coal

TEST *5. October 25, 1912.

ture Flue Gases leaving Boiler Tubes

TEST * 5. October 25, 1912.

B.H.P. 118 — TEST * 5. Oct. 25, 1912 — 128.2 I.H.P.

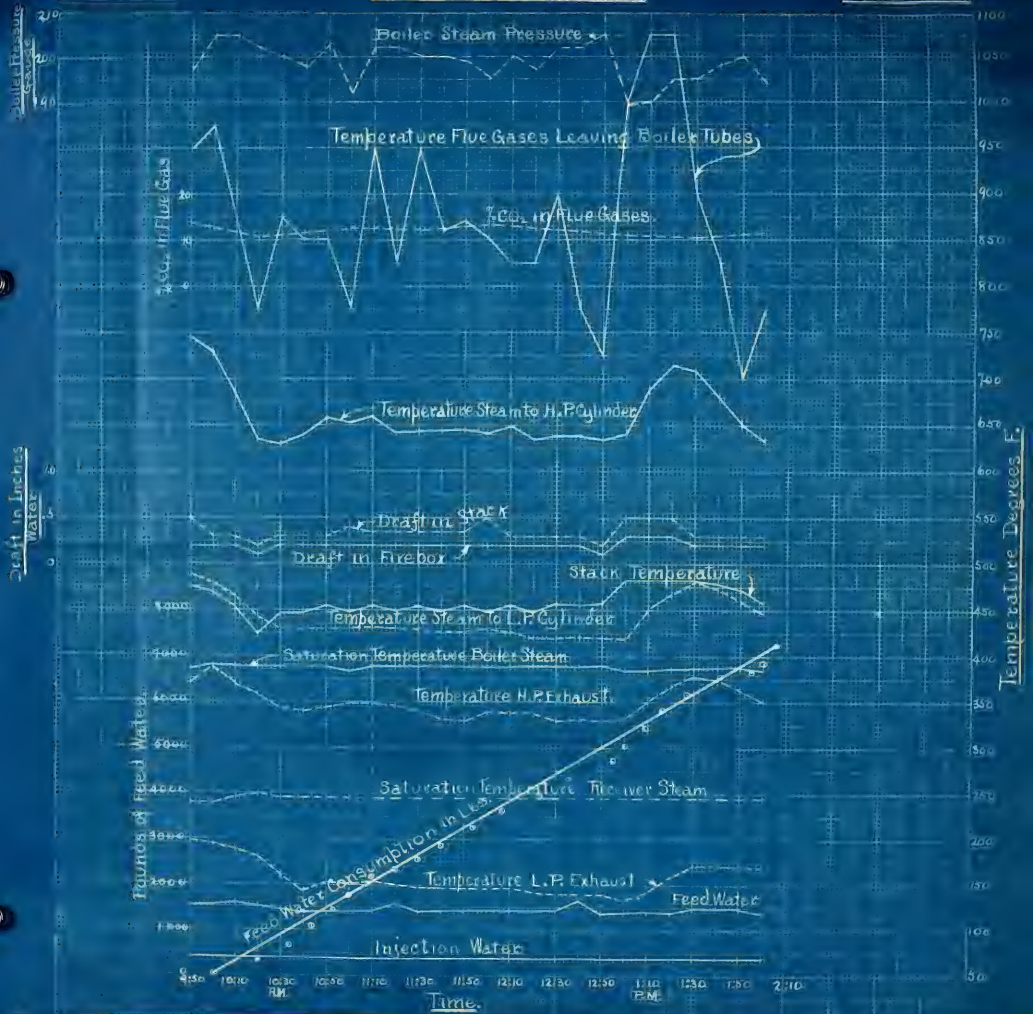
No. of Hours Run	R.P.M.	Net Wt. on Scales	B.H.P.	M.E.P.s. H.P. Cyl.	M.E.P.s. L.P. Cyl.	M.E.P.s. Referred to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum 30" Bar.	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks
3½	205.5	560	118	58.4	10.1	24.42	128.2	3137	1255	10.9	9.78	1031	2065	1.8	1.61	27.38	201.5	227.6	164.1	Alden Brake. Pittsburgh Coal

TEST # 6. Oct. 28, 1912. 163.5 I.H.P.

TEST # 6. Oct. 28, 1912 163.5 I.H.P.

s. Referred to L.P. Cyl	I.H.P.	Water in Lbs. Total	Per Hour	Per B.H.P. Hr.	Per I.H.P. Hr.	Coal in Lbs. Total	Per Hour	Per B.H.P. Hr.	Per I.H.P. Hr.	Vacuum 30" Bar	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl	L.P. Cyl	Remarks
31.2	163.5	7238	1765	11.45	10.8	1084	265	1.72	1.62	27.27	198.5	293.5	196	Alden Brake Pittsburgh Coal

B.H.P. 154. TEST # 6. Oct. 28, 1912. 163.5 I.H.P.



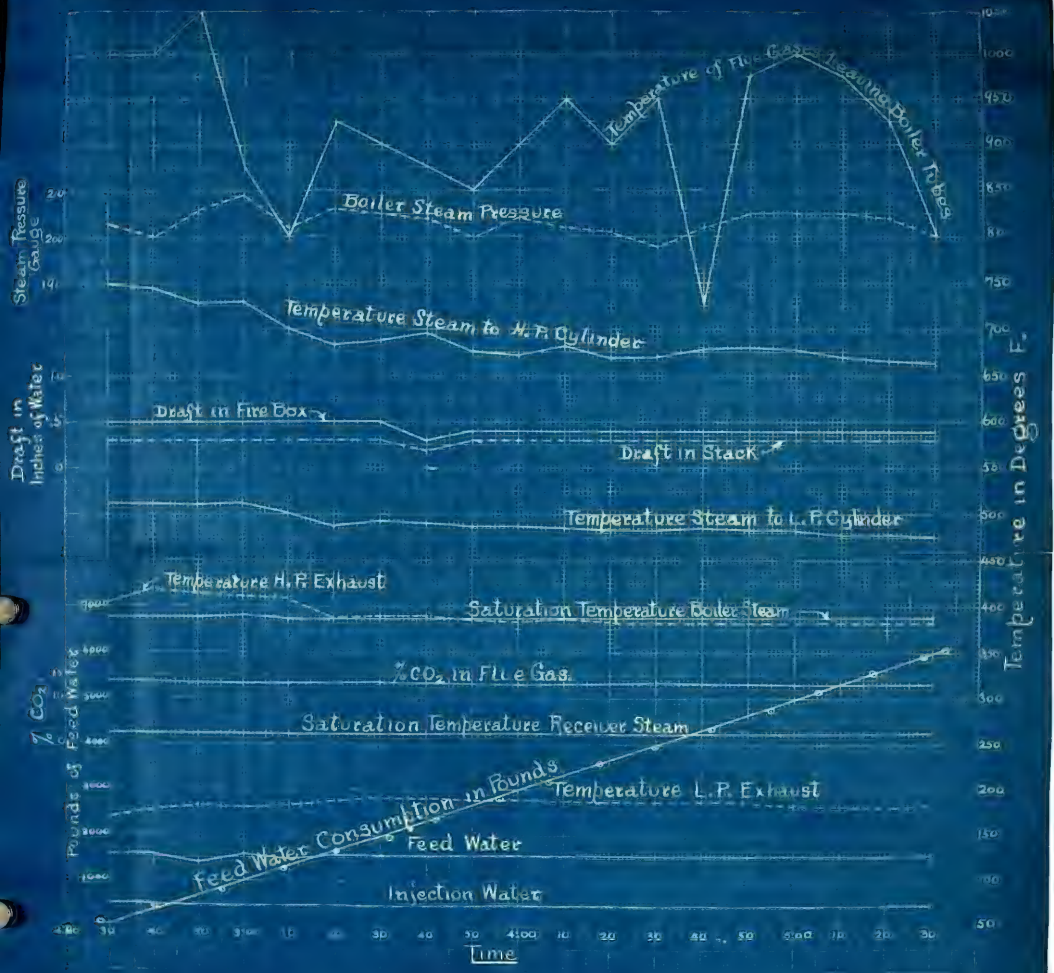
B.H.P. 154. TEST # 6. Oct. 28, 1912 163.5 I.H.P.

Hours of Run.	R.P.M.	Net Wt. on Scales	B.H.P.	M.E.Ps. H.P. Cyls.	M.E.Ps. L.P. Cyls.	M.E.Ps. Referred to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum in Bar.	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks
4 1/10	2059	780	154	217	137	312	163.5	7238	1763	11.45	10.8	1084	265	1.72	1.62	27.27	198.5	273.5	148	Alden Brake Pittsburgh Coal

TEST #7. OCTOBER 29, 1912. I.H.P. 200.

HPs. Referred to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum 30" Bar	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks.
38.11	200	6037	1975	10.25	9.9	977	320	1.67	1.6	27.23	204	302	229	Alden Brake. Pittsburg and Hawick Coal Used

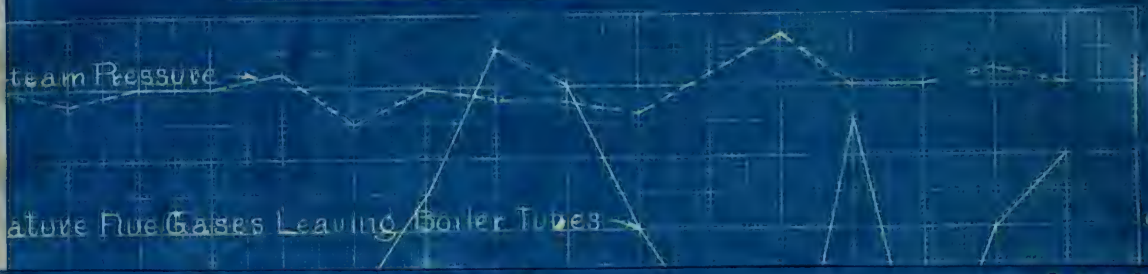
B.H.P. 192. TEST "7. OCTOBER 29. 1912. I.H.P. 200.



B.H.P. 192 TEST "7. Oct. 29, 1912. 200 I.H.P.

Hours of Run	R.P.M.	Net Wt. on Scales	B.H.P.	M.E.P. H.P. Cyl.	M.E.P. L.P. Cyl.	M.E.P. Referred to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum 30 Bar.	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyl.	Remarks.
3 1/20	206.6	930	192	33.2	17.9	38.11	200	6037	1975	10.25	9.9	977	320	1.67	1.6	27.23	204	302	229	Alden Brake. Pittsburg and Hocking Coal used

TEST # 10. Nov. 6, 1912. 846 I.H.P.



TEST # 10. NOV. 6, 1912. 846 I.H.P.

M.E.Ps.			I.H.P.	Water in Lbs.				Coal in Lbs.				Vacuum	Steam Pressure	Superheat Temperatures		Remarks
H.P. Cyl.	L.P. Cyl.	Reduced to L.P. Cyl.		Total	Per Hour	Per B.HP Hr	Per I.HP Hr	Total	Per Hour	Per B.HP Hr	Per I.HP Hr	30" Bar	Gauge	H.P. Cyl.	L.P. Cyl.	
9.5	6.6	16.1	84.6	3385	1128	14.65	13.3	496	165	2.14	1.95	27.75	200	170.4	119.5	Holwick Coal. Coking Method of Firing Used

B.H.P. 77. TEST #10. Nov. 6, 1912. 84.6 I.H.P.

B.H.P. 77. TEST #10. Nov. 6, 1912. 84.6 I.H.P.

Hours of Run	R.P.M.	Net Wt. on Scales	B.H.P.	M.E.P.s H.P. Cyl.	M.E.P.s L.P. Cyl.	M.E.P.s Referd to L.P. Cyl.	I.H.P.	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per B.H.P. Hr.	Water in Lbs. Per I.H.P. Hr.	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per B.H.P. Hr.	Coal in Lbs. Per I.H.P. Hr.	Vacuum 30" Bar.	Steam Pressure Gauge	Superheat Temperatures H.P. Cyl.	Superheat Temperatures L.P. Cyls.	Remarks
3	205.6	375	77	17.5	6.6	16.1	84.6	3385	1128	14.65	13.3	496	165	2.14	.95	27.75	200	170.4	119.5	Holmes Coal. Coking Method of Firing Used

TEST * 11. March 30, 1913. 150.2 I.H.P

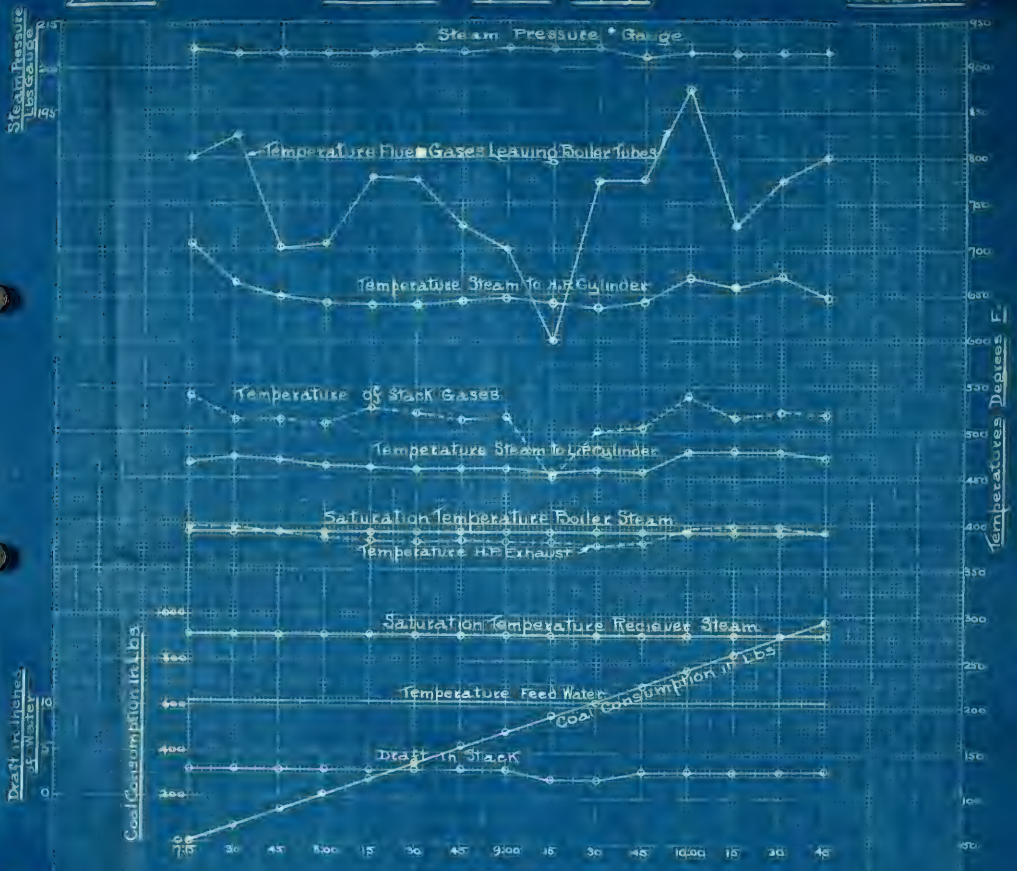
SPECIAL TEST * 11. Mar. 30, 1913. Non Condensing 150.2 I.H.P

	Water in Lbs.				Coal in Lbs.				Vacuum	Steam Pressure	Degrees Superheat		Remarks
	Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	30 Bar	Gauge	H.T. c.g.t.	I.P. c.g.t.	
8%					976	279	2.99	1.856	—	208	262	189	Salem Coal Good Quality Hand Fired.

Salem Lump

ure	1.63%
le Matter	41.17
Carbon	51.10
	6.10
	100.00

93.4 K.W. TEST " 11 March 30, 1913. 150.2 I.H.P.



93.4 K.W. SPECIAL TEST " 11. Mar. 30, 1913. Non Condensing 150.2 I.H.P.

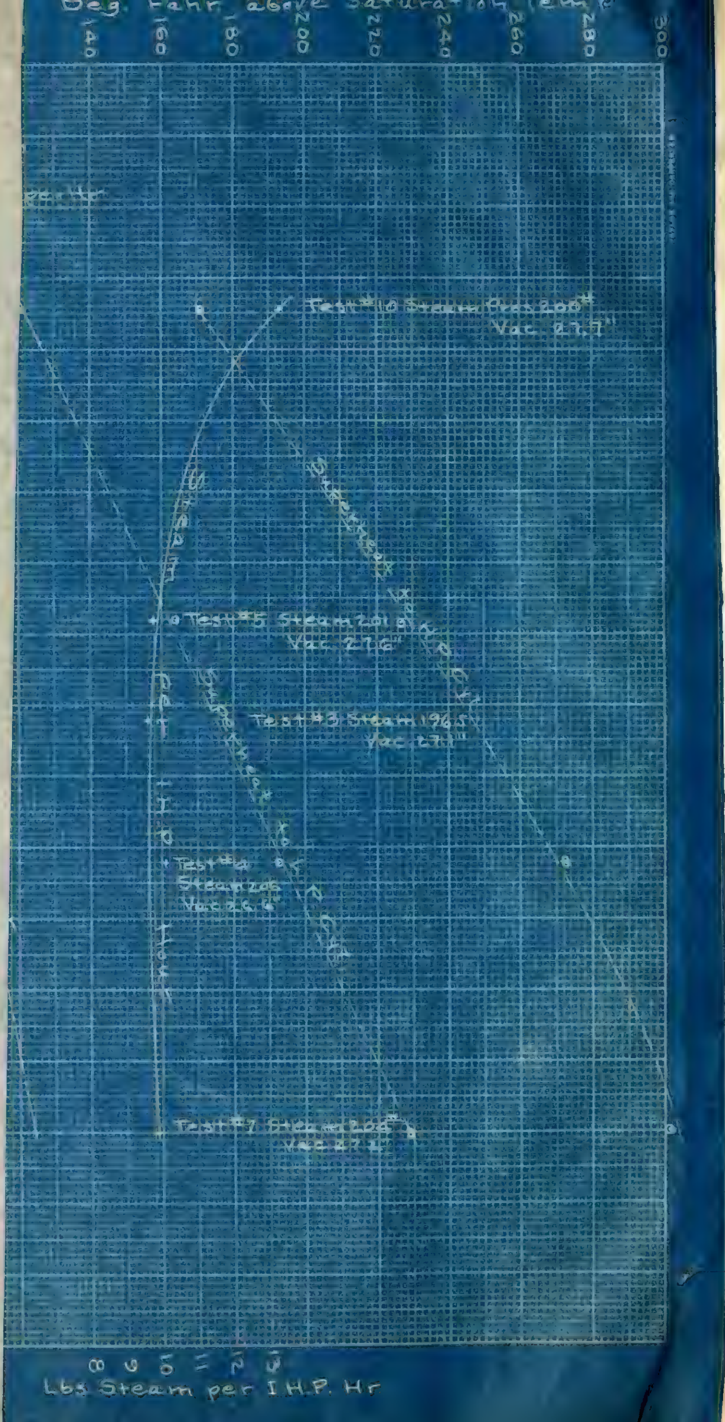
Hours of Run	R.P.M.	Total K.W. Hours	K.W. per Hour	I.H.P.	Load Factor	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per K.W. Hour	Water in Lbs. Per I.H.P. Hour	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per K.W. Hour	Coal in Lbs. Per I.H.P. Hour	Vacuum 30 Bar.	Steam Pressure Gauge	Degrees Superheat Deg. Cyl.	Degrees Superheat L.P. Cyl.	Remarks
3½	206	321	93.4	150.2	74.87					976	279	2.99	1.856	—	208	262	189	Salem Coal Good Quality Hand Fired

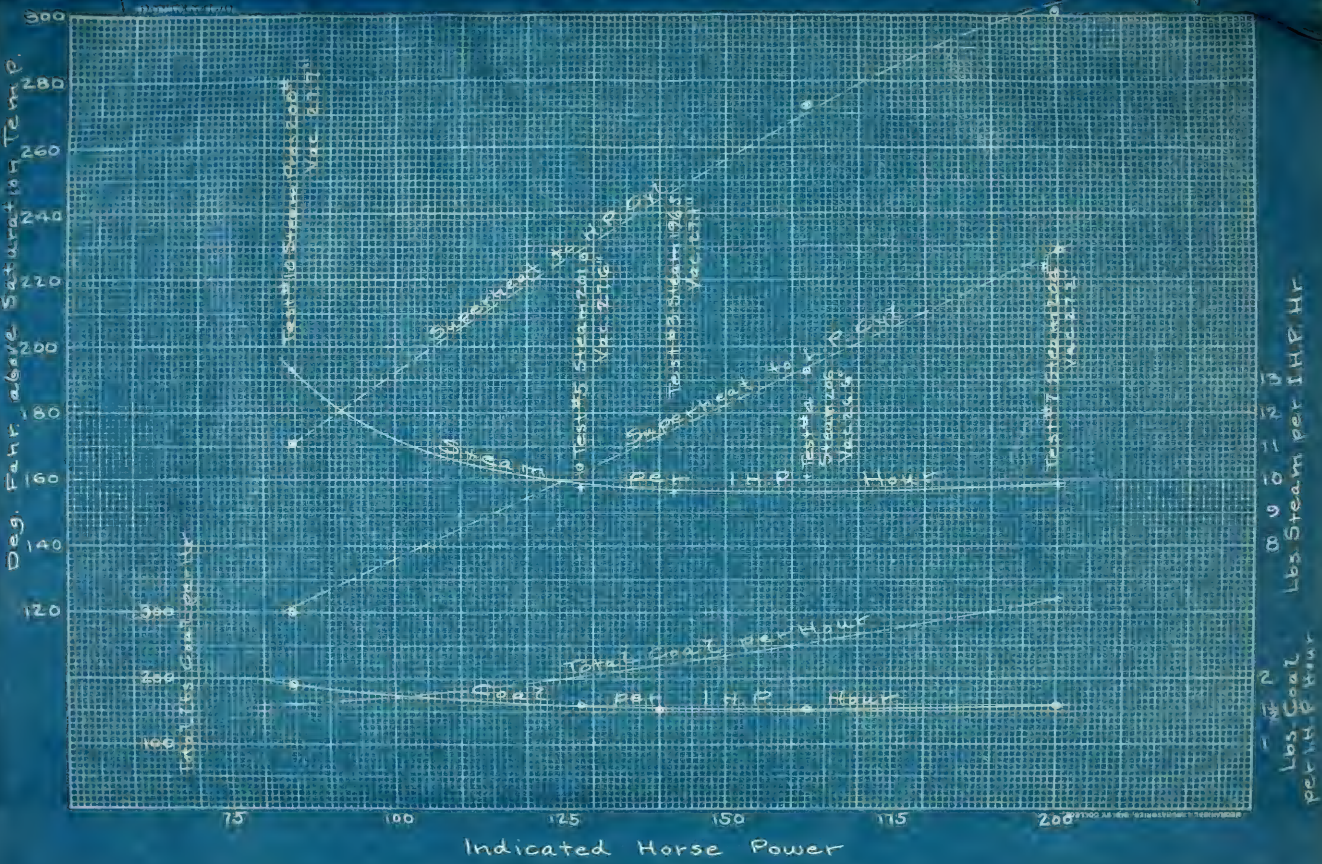
Analysis of Coal as Fired. Salem Lump

Moisture	1.63 %
Volatile Matter	41.17
Fixed Carbon	51.10
Ash	6.10
	100.00

Sulphur - 2.63

B.T.U. per Lb. - 14282.31


Deg. Fahr. above Saturation Temp.
140
160
180
200
220
240
260
280
300
Test #10 Steam Pres. 200#
Vac. 27.7"
Superheat
Steam
Test #5 Steam 201#
Vac. 27.6"
Test #3 Steam 196.5
Vac. 27.1"
Test #2
Steam 206
Vac. 26.6"
Test #7 Steam 206
Vac. 27.1"
8
9
10
11
12
13
Lbs. Steam per I.H.P. Hr



Graphical Summary of Economy Test.

175 H.P. Buckeye Superheated Steam Unit

BUCKEYE ENGINE CO. SALEM OHIO

Oct.-Nov. 1912

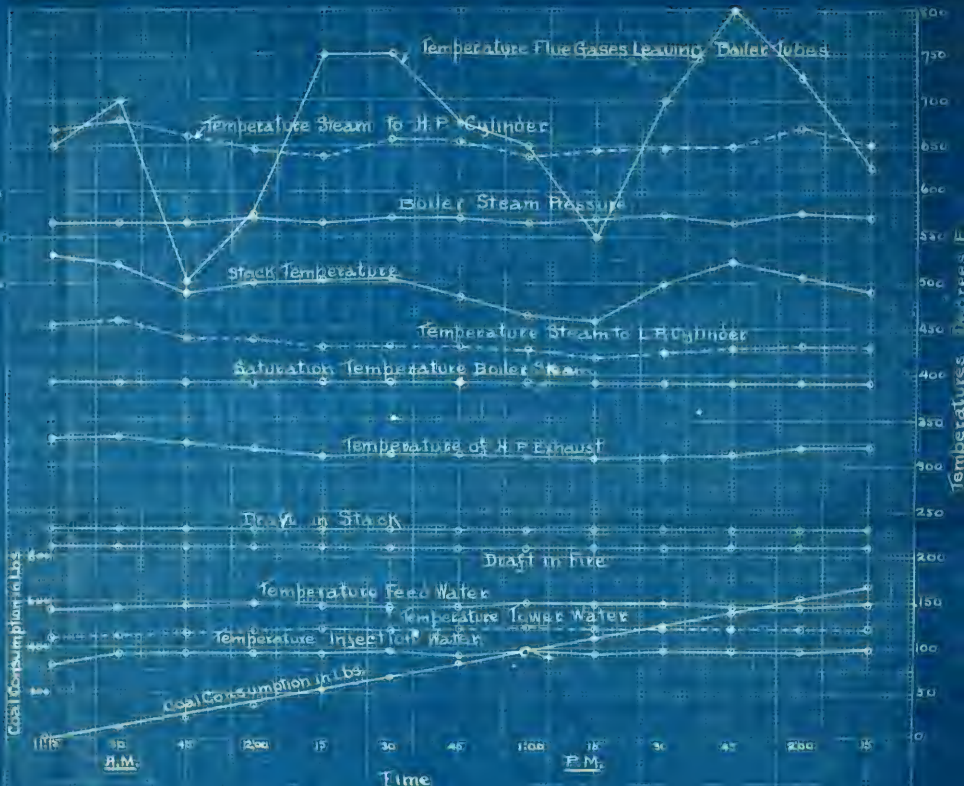
TEST #12 March 30, 1913. 160 I.H.P.

Load Factor	Water in Lbs. Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Coal in Lbs. Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Vacuum Bar.	Steam Pressure Gauge	Degrees Superheat H.P. cyl.	L.P. cyl.	Remarks.
76.5%					673	2243	2.35	1.40	23 1/4	208.5	263	189.4	Salem Coal. Good Quality Hand Fired.

Salem Lump.

Ash	1.63 %
Volatile Matter	41.17
Fixed Carbon	51.10
Moisture	6.10
	100.00

95.6 K.W. TEST #12 March 30, 1913. 100 I.H.P



95.6 K.W. SPECIAL TEST #12. Mar. 30, 1913. Condensing. 100 I.H.P

Hours of Run	Total K.W. Hours	K.W. per Hour	% Load Factor	Water in Lbs. Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Coal in Lbs. Total	Per Hour	Per K.W. Hour	Per I.H.P. Hour	Vacuum 30 Bar	Steam Pressure Gauge	Degrees Superheat H.P. cut.	Degrees Superheat L.P. cut.	Remarks
3 06	287	95.6	100	765				673	224.3	2.35	1.40	23¼	208.5	262	159.4	Salem Coal Good Quality Hand Fired.

Analysis of Coal as Fired. – Salem Lump.

	Moisture	1.63 %
	Volatile Matter	41.17
	Fixed Carbon	51.10
Sulphur - 363	Ash	6.10
B.T.U. per Lb. 14282.31		100.00

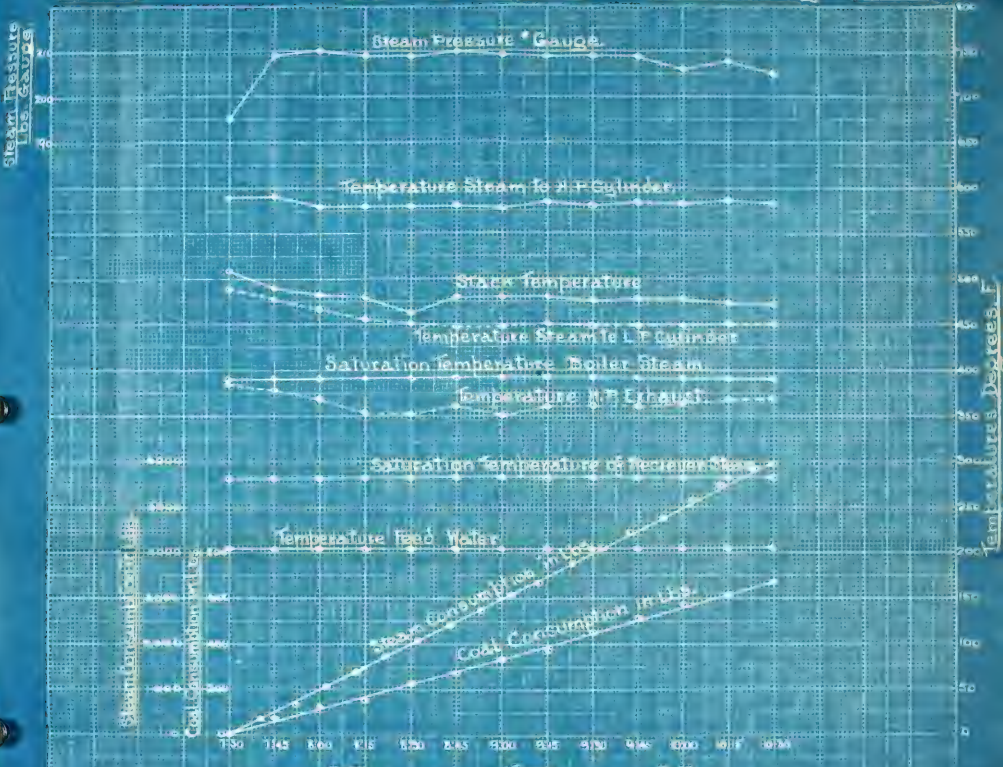
TEST * 13. May 4, 1913. Non Condensing 153.5 I.H.P.

		Hour	Hour	Hour		Hour	Hour	Hour	30 Bar		Cwt.	Cwt.	
76.5%	5941	1980/3	20.7	18.9	66.8	222	2.33	1.45	—	2.06	193	177	Pocahontas Lump Hand Fired.

ed. Pocahontas Lump

isture	.27%
latile Matter	18.03
xed Carbon	76.70
sh	5.00
	100.00

95.7 K.W. TEST * 13 May 4, 1913. Non Condensing 153.5 I.H.P.



95.7 K.W. SPECIAL TEST * 13 May 4, 1913. Non-Condensing. 153.5 I.H.P.

Hours of Run	K.E.M.	Total K.W. Hours	K.W. per Hour	I.H.P.	Load Factor	Water in Lbs. Total	Water in Lbs. Per Hour	Water in Lbs. Per K.W. Hour	Water in Lbs. Per I.H.P. Hour	Coal in Lbs. Total	Coal in Lbs. Per Hour	Coal in Lbs. Per K.W. Hour	Coal in Lbs. Per I.H.P. Hour	Vacuum Inches	Steam Pressure Gauge	Degrees Superheat H.P. Cyl.	Degrees Superheat L.P. Cyl.	Remarks.
3	200	287	95.7	153.5	76.57	5941	1980	20.7	12.9	1611	537	5.62	3.5	—	202	198	177	Pocahontas Lump Hand Fired

Analysis of Coal as Fired Pocahontas Lump

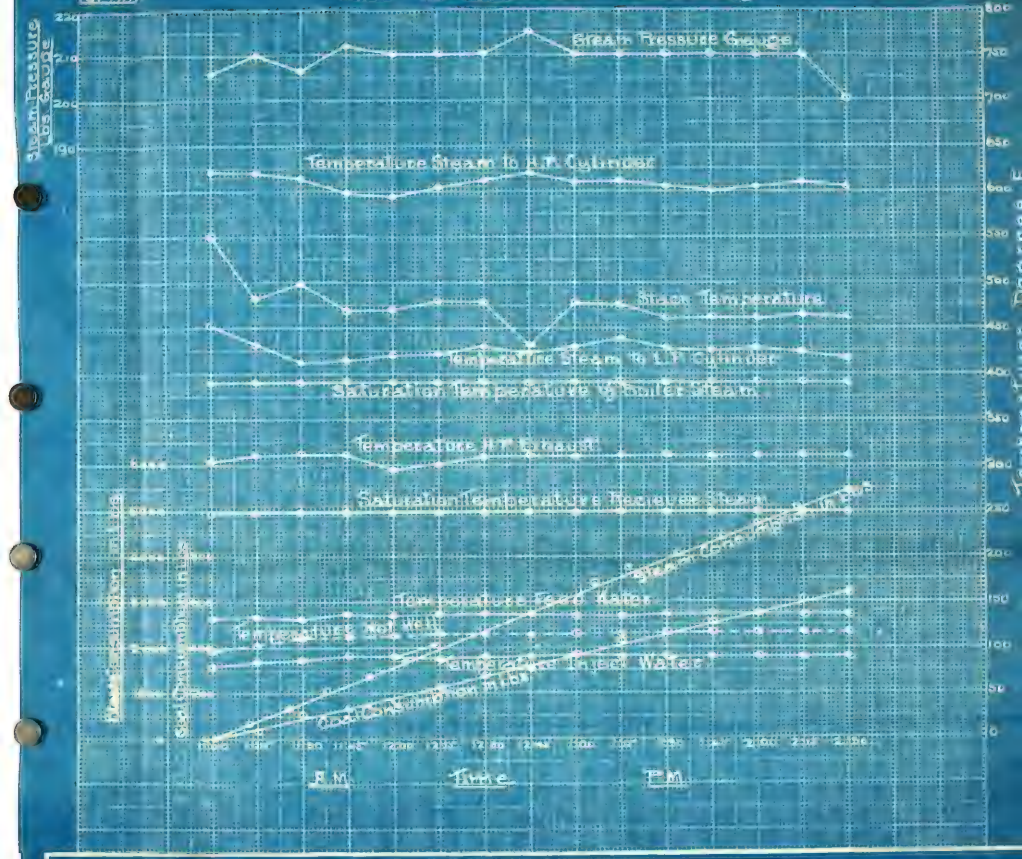
Moisture	2.7%
Volatile Matter	18.03
Fixed Carbon	76.70
Ash	5.00
	100.00

Sulphur ~ .56%.

B.T.U. per Lb. 14209.6

TEST " 14. May 4, 1913. Condensing 168.5 I.H.P.

101 K.W. TEST # 14. May 4. 1913. Condensing 168.5 I.H.P.



101.4 K.W. SPECIAL TEST # 14 May 4, 1913. Condensing 169 I.H.P.

Hours of Run	R.P.M.	Total K.W. Hours	K.W. per Hour	I.H.P.	Load Factor	Water in Lbs Total	Water in Lbs Per Hour	Water in Lbs Per K.W. Hour	Water in Lbs Per I.H.P. Hour	Coal in Lbs Total	Coal in Lbs Per Hour	Coal in Lbs Per K.W. Hour	Coal in Lbs Per I.H.P. Hour	Vacuum 30 bar	Steam Pressure Gauge	Degrees Superheat H.P. Cut	Degrees Superheat L.P. Cut	Remarks.
3½	200	355	101.4	169	81%	5440	1530	15.4	9.2	639	182.5	1.8	1.08	25.7	209	248	178	Pocahontas Lump Hand Fired

Analysis of Coal as Fired Pocahontas Lump

	Moisture	2.17%
	Volatile Matter	18.03
	Fixed Carbon	76.70
Sulphur .56%	Ash	5.00
B.T.U. per Lb. 14209.6		100.00